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Field Life Table of *Spodoptera litura* Fabricius on Castor

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Abstract – **Investigations on field life table revealed that NPV, bacterial infection and unknown reasons are the key mortality factors in the younger group larvae. Diseases like NPV, bacterial infection, unknown factor, parasites like *Cotesia* sp., and *Tachinid* maggot are the key mortality factors in the older group larvae. NPV and unknown factors are the key mortality factors in the pupal stage. Generation survival (SG) was worked out to the tune of 0.39. The trend index was found to be 0.018. The positive value of the trend index indicated that the mortality factors operating during this period were not effective in suppressing the pest population in succeeding generations.**

Keywords – **Ecological Life Table, *Spodoptera litura,* Key Mortality Factors & Castor.**

I. Introduction

Castor (*Ricinus communis* Linnaeus) is one of the most important oilseeds crop. India is the largest producer of castor seed and oil. It is of great importance for industrial, manures and medicinal use. Apart from fulfilling the internal demand of oil for various industries in recent years, it has played an important role in earning substantial foreign exchange through export of castor oil. The castor oil finds diversified application in industries and hence, there is a great demand in industrially developed countries. It is used in production of paints and varnishes, lacquers, sulfonated oils, artificial leathers, lubricants and greases, hydraulic fluids, cosmetics, soaps, printing ink and linoleum. It also serves as a raw material of various important chemical such as sebacic acid and for the manufacture of nylon. Further, its cake is excellent manure containing 4.5 per cent nitrogen, 2.6 per cent phosphoric acid and 1.0 per cent potash. The castor hulls are used as manure after decomposition and its stalks are useful in manufacturing paper, cardboard and also widely used as a fuel and building huts.

Castor is one of the important cash crop which can be grown under varying soil types and erratic nature of monsoon due to its drought tolerance habit. The crop is cultivated in about 30 countries including India. India is the largest producer of castor seed and oil, which account for 5 per cent area and 64 per cent production in the world (Damodaran and Hegde, 2002).

In India the castor is cultivated in the states of Gujarat, Andhra Pradesh, Tamilnadu, Karnataka and Orissa accounting for about 90% of the area and production. It is cultivated in an area of 8.52 lakh hectare with a production of 10.2 lakh ton of castor seed with productivity being 1331 kg/ha during 2008-09 in India. Gujarat ranked the first in area and production with 4.03 lakh hectare producing about 8.5 lakh ton of castor seed annually along with an average productivity of 1972 kg per hectare (Anonymous, 2009).

Among the various pests attacking the crop, castor leaf eating caterpillar, *S. litura*, commonly known as tobacco caterpillar, a polyphagous pest is occurring in the entire castor growing countries in Asia, Australia and the Pacific basin (Feakin, 1973) and causes extensive damage to the crop at its initial stage. Its outbreaks also occur in Saurashtra region of the Gujarat State. Earlier, the pest was referred with different scientific synonymous viz., *Noctua litura* Mmssn, *Prodenia reline* Frans and *Prodenia litura* Fabricius (Anonymous, 1986b; Lefroy, 1908).

The loss caused by *S. litura* in different castor cultivars has been estimated to the tune of 12.0 to 23.50 per cent under Junagadh condition (Anonymous, 1986a).

II. Materials & Methods

A non-replicated field experiment on life tables and key mortality factors of *S. litura* on castor were conducted at Instructional Farm at College of Agriculture, Junagadh during *kharif* 2011-12. The variety GG-20 was sown at the spacing of 60 x 10 cm. The experiment comprised of 20 quadrates which is of 1 m x 1 m maintained under pesticide free conditions. On germination of crop, frequent visits were made to record the first incidence of *S. litura* , the known number of eggs as a start of first generation of *S. litura* were collected along with the plant material. Since the generations were overlapping and the pest also surviving in the other crops, the eggs could not be collected in the field. The tiny larvae collected from the field were reared in the laboratory in small plastic boxes till the cessation of pest population in the field. This laboratory culture was used as a check culture for deciding the no of regular generations of pest in the field conditions.

The sampling of early and late instar larvae was done on the basis of development of pests in the laboratory reared culture. At each observation five quadrates were carefully observed twice in the week for the number of larvae of *S. litura*. The field collected larvae were brought to the laboratory and reared on respective castor leaves. This was referred as field culture. The food was changed as and when required. The culture was reared till the adult emergence. The observations were made on diseases, parasitism and unknown reasons in the larval and pupal stages.

The column headings used in the life table of the present study are similar to those used by Morris and Miller (1954) and (1969) are as under.

x = The age interval, egg, larva, pupa or adult
lx = The number surviving at the beginning of stage noted in the 'x' column
dx = The number dying within age interval stated in the 'x' column

dxf = The mortality factor responsible for ‘dx’
100qx = Per cent mortality
sx = Survival rate within the age mentioned in the ‘x’ column

III. Results & Discussion

Field life table was constructed to understand the role of various mortality factors of *S. litura*. The investigations were carried out under field as well as laboratory conditions during the year 2011-12 on castor crop at College of Agriculture, JAU, and Junagadh. Life table and budget were also worked out to find out the key mortality factors that influence the population of this pest.

Field life table of the *S. litura* on castor was constructed by counting the absolute larval population at weekly interval. The data for life table of *S. litura* on castor are given in the Table.1, which showed natural and sequential mortality in the field population during the crop season. Per cent mortality in the eggs contributed around 10 %. The mortality in the egg stage was mainly due to egg sterility. Larval mortality was recorded by grouping the larvae into two groups, younger larval group (I and II instar) and older larval group (III to VI instar). The results revealed that there were 2.21 and 53.47 per cent mortality in the younger and older larval groups, respectively. The results further revealed that the mortality in the younger group larvae was mainly due to NPV, bacterial infection and unknown reasons. The larval population of older group declined by 53.47 per cent owing to different diseases caused by NPV, bacterial infection, parasitoids like *Cotesia* sp. and *Tachinid* maggot, during pupal stage, NPV and unknown factors were the major mortality factors operating under field conditions. The mortality in pupal stage was mainly due to NPV, contributed around 3.11 per cent and unknown reasons contributed around 2.25 per cent mortality. Generation survival (SG) was worked out and it was found 0.39. Value of trend index (I) was calculated to the tune of 0.018. The positive value of the trend index indicated that the mortality factors operating during this period were not effective in suppressing the pest population in succeeding generations.

Results of key factor analysis (Table. 1 & Fig. 1 & 2) revealed that maximum mortality was occurred in the older group larvae as the highest value of ‘k’ was obtained for this group. It was also observed that among the different mortality factors in younger group larvae diseases (NPV, bacterial infection and unknown reason) caused the maximum mortality. The ‘k’ value of this factor was 0.008. The mortality in older group larvae was attributed mainly due to NPV, bacterial infection and unknown factor to the tune of 0.156, 0.015, and 0.025, respectively. The mortality pupal stage was attributed due to NPV and unknown reasons. The ‘k’ values of these factors were 0.032 and 0.021, respectively. Thus, the data further revealed that among the different life stages of the pest, the maximum population declined in larval stage as the ‘k’ value for this stage was to the tune of 0.346.

The present findings are more or less similar to the results reported by Ali (1992); Paras and Rakesh (1999); Rojas *et al.* (2000b); Jadav *et al.* (2006); Jagtap *et al.* (2007); Patiat *et al.* (2009) and Kamble *et al.* (2007).

IV. Summary & Conclusion

Ecological life table of *S. litura* on castor were constructed under field conditions to determine the key mortality factors. The data indicated that various factors like NPV, bacterial infection and unknown factors in the younger group larvae, diseases caused by NPV, bacterial infection, unknown factors and parasitoids like *Cotesia* sp. and *Tachinid* maggot in the older group larvae, NPV and unknown reasons in the pupal stage were found most effective in reducing the pest population.

Results reveal that mortality in the younger group larvae, an older group larva and pupal stage was 2.21 per cent, 53.47 per cent and 5.11 per cent, respectively. Generation survival (SG) was worked out and found it was 0.39. Value of trend index (I) were calculated to the tune of 0.018. The positive value of the trend index indicated that the mortality factors operating during this period were not effective in suppressing the pest population in succeeding generations.

The results of the present investigation revealed that the NPV, bacterial infection, unknown factor and parasitoids *viz.*, *Cotesia* sp., *Tachinid* maggot were major key mortality factors. The above bioagents can be mass reared in the laboratory and released in the field during peak infestation of pest to manage the pest population. This will also reduce the pesticidal application, hence, helps in minimizing the insecticidal pollution and hazards.

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TABLE 1: KEY MORTALITY FACTORS OF SPODOPTERA LITURA ON CASTOR

Age interval **X**	No. alive/ha **Lx**	Factor responsible for dx **Dxf**	No. dying during x **Dx**	Mortality per cent **100qx**	Survival within x **sx**
Younger larvae (N_1)	25000				
I and II instar larvae		NPV	333.3	1.33	0.97
		Bacterial infection	55.5	0.22	
		Un known factors	166.6	0.66	
			555.4	**2.21**	
Older larvae	24,444.6				
III to VI instar larvae		**Diseases**			0.45
		NPV	7333.3	29.3	
		Bacterial infection	555.5	2.22	
		Unknown factors	944.4	3.77	
		Parasitoids			
		Cotesia sp.	3333.3	13.3	
		Tachinid maggot	1222.2	4.88	
			13,388.7	**53.47**	
Pupae	11,055.9				
		NPV	777.7	3.11	0.88
		Unknown reasons	500	2.00	
			1277.7	**5.11**	
Moths	9,778.2				1.00
Femalesx2 (N_3)	9,778.2				1.00
Normal females X 2	9,778.2				1.00
Generation total	15,221.8			**60.79**	
Trend index (**I**) (N_2/N_1)			0.018	**K's**	0.70
Generation survival (**SG**) (N_3/N_1)			0.39		

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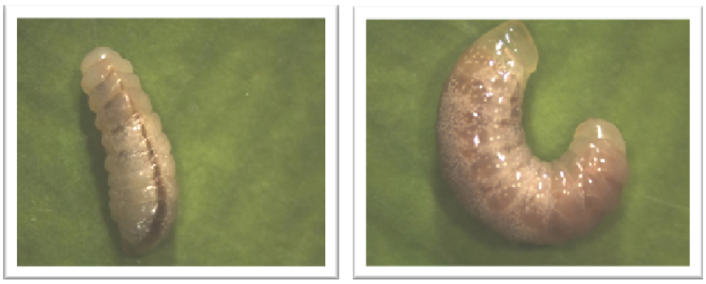
Larva liquefied due to NPV Bacteria Infected Larvae

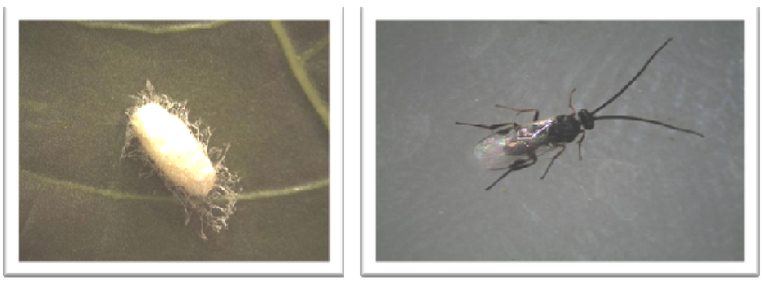
NPV infected larvae NPV infected pupa

Fig. 1. Various disease infections during larval & pupal stage

Parasitized Larvae



Dipterans (*Tachinid*) Maggot



Adult Pupa

Cotesia Sp. emerged from the larva

Fig. 2. Emergence of various parasitoids