



E-ISSN: 2320-7078

P-ISSN: 2349-6800

JEZS 2020; 8(1): 584-586

© 2020 JEZS

Received: 06-11-2019

Accepted: 10-12-2019

Lekha

Department of Entomology,
Rajasthan College of Agriculture,
Maharana Pratap University of
Agriculture and Technology,
Udaipur, Rajasthan, India

MK Mahla

Department of Entomology,
Rajasthan College of Agriculture,
Maharana Pratap University of
Agriculture and Technology,
Udaipur, Rajasthan, India

H Swami

Department of Entomology,
Rajasthan College of Agriculture,
Maharana Pratap University of
Agriculture and Technology,
Udaipur, Rajasthan, India

AK Vyas

Department of Entomology,
Rajasthan College of Agriculture,
Maharana Pratap University of
Agriculture and Technology,
Udaipur, Rajasthan, India

KC Ahir

Department of Entomology,
Rajasthan College of Agriculture,
Maharana Pratap University of
Agriculture and Technology,
Udaipur, Rajasthan, India

Corresponding Author:**KC Ahir**

Department of Entomology,
Rajasthan College of Agriculture,
Maharana Pratap University of
Agriculture and Technology,
Udaipur, Rajasthan, India

Biology of fall armyworm, *Spodoptera frugiperda* (J.E. Smith) on different artificial diets

Lekha, MK Mahla, H Swami, AK Vyas and KC Ahir

Abstract

The biology of fall armyworm, *Spodoptera frugiperda* (J.E. Smith) was studied during June – August 2019 under laboratory conditions at the Department of Entomology, Rajasthan College of Agriculture, MPUAT, Udaipur. The biology was studied on five different artificial diets *i.e.* D₁ (Cowpea + Yeast + Sorbic acid + Ascorbic acid + Methyl-p-hydroxy benzoate + Agar + Multivitamin solution + Formaldehyde + Distilled water), D₂ (Chickpea + Yeast + Sorbic acid + Ascorbic acid + Methyl-p-hydroxy benzoate + Agar + Multivitamin solution + Formaldehyde + Distilled water), D₃ (Black gram + Yeast + Sorbic acid + Ascorbic acid + Methyl-p-hydroxy benzoate + Agar + Multivitamin solution + Formaldehyde + Distilled water), D₄ (Green gram + Yeast + Sorbic acid + Ascorbic acid + Methyl-p-hydroxy benzoate + Agar + Multivitamin solution + Formaldehyde + Distilled water) and D₅ (Soybean + Yeast + Sorbic acid + Ascorbic acid + Methyl-p-hydroxy benzoate + Agar + Multivitamin solution + Formaldehyde + Distilled water). The minimum larval (I instar to VI instar) and pupal period were recorded on D₅ followed by D₂ and D₁, whereas the maximum larval period (I instar to VI instar) and pupal period were recorded on black gram and green gram *i.e.* D₃ & D₄, these both were found significantly at par with each other. The maximum adult (male and female) longevity and fecundity were recorded on soybean (D₅) followed by chickpea and cowpea (D₂ & D₁), whereas minimum adult (male and female) longevity and fecundity were recorded on black gram and green gram *i.e.* D₃ & D₄.

Keywords: *Spodoptera frugiperda*, soybean, chickpea, fecundity, larval period, artificial diet

1. Introduction

The fall armyworm, *Spodoptera frugiperda* (J.E. Smith) is native to the tropical and subtropical region of America and is one of the most important pest causing enormous damage in the region [1]. Fall armyworm, *S. frugiperda* is highly polyphagous, causing economic damage to various crops such as maize, sorghum, beans and cotton [2, 3]. *S. frugiperda* has invaded Africa, with first reported in West Africa in late 2016 [4] and in late 2016 and 2017 in parts of Southern, Eastern and Northern Africa [5]. Recent reports were confirmed the occurrence of fall armyworm in 28 countries in Africa [3, 6] indicating the rapid spread of the pest in the African continent, threatening the food security of millions of people. In India, it was reported for the first time on maize from Shivamogga district of Karnataka during May-June 2018 [7]. Fall armyworm is of serious concern due to its notorious and polyphagous behaviour. The main reason for its fast spread might be its strong capacity to fly and disperse long distances. The invasion of this pest could also be due to advances in agriculture, global trade and transport and human activities despite strict quarantine norms. According to recent studies, fall armyworm can cause maize yield losses ranging from 8.3 million tonnes to 20.6 million tonnes per year in absence of management practices [3]. This pest caused heavy damage to maize crop in Southern Rajasthan during *Kharif*, 2019. Immediate focus of research on this pest is the need of the hour for which, a complete knowledge of biology of *S. frugiperda* plays a great role for identifying the life stages and also for planning IPM strategies. Keeping in view the above facts, the study on “Biology of *Spodoptera frugiperda* (J.E. Smith) on different artificial diets” was carried out under Laboratory condition.

2. Materials and Methods

The biology of fall armyworm, *S. frugiperda* on different artificial diets was studied under laboratory conditions at the Department of Entomology, Rajasthan College of Agriculture, MPUAT, Udaipur during June – August, 2019. The culture of fall armyworm, *S. frugiperda* was initiated with larvae collected from maize fields at farm of RCA, Udaipur. The species

was identified and confirmed through morphological characters. Initially the larvae were reared on maize leaves for nucleus culture, till the egg laid by females. After hatching of eggs, fresh maize leaves were provided to the first instar larvae and after one moult the second instar larvae were

transferred on different artificial diets viz., D₁, D₂, D₃, D₄ and D₅ (Table-1). The observations on the different biological parameters viz., incubation period, larval period, pre pupal period, pupal period, adult male and female longevity of *S. frugiperda* was recorded on different artificial diets.

Table 1: Composition of the artificial diets for *Spodoptera frugiperda*

Constituent	D ₁	D ₂	D ₃	D ₄	D ₅
Cowpea flour	100.0 g	-	-	-	-
Chickpea flour	-	100.0 g	-	-	-
Black gram flour	-	-	100.0 g	-	-
Green gram flour	-	-	-	100.0 g	-
Soybean flour	-	-	-	-	100.0 g
Yeast extract	10.0 g	10.0 g	10.0 g	10.0 g	10.0 g
Methyl-p-hydroxy benzoate	2.0 g	2.0 g	2.0 g	2.0 g	2.0 g
Sorbic acid	1.0 g	1.0 g	1.0 g	1.0 g	1.0 g
Ascorbic acid	3.6 g	3.6 g	3.6 g	3.6 g	3.6 g
Multivitamin solution	7.0 ml	7.0 ml	7.0 ml	7.0 ml	7.0 ml
Formaldehyde	5.0 ml	5.0 ml	5.0 ml	5.0 ml	5.0 ml
Agar	12.0 g	12.0 g	12.0 g	12.0 g	12.0 g
Distilled water	800.0 ml	800.0 ml	800.0 ml	800.0 ml	800.0 ml

3. Results and Discussion

The minimum larval period from I instar to VI instar (14 days), pre pupal period (4 days) and pupal period (7 days) were recorded on D₅ (Table-2). The larval period, pre pupal period and pupal period on D₂ and D₁ were 14.50, 4.33 and 7.33 days; 15.00, 4.50 and 8.00 days, respectively. Whereas, the maximum larval period (I instar to VI instar), pre pupal period and pupal period were recorded on black gram and green gram i.e. D₃ and D₄ were 18.00, 6.17 and 10.50 days; 18.50, 6.50 and 11.00 days, respectively. These both were found significantly at par with each other. The maximum adult (male and female) longevity and fecundity were recorded on soybean (D₅) followed by chickpea and cowpea (D₂ & D₁), whereas minimum adult (male and female) longevity and fecundity were recorded on black gram and

green gram i.e. D₃ and D₄. The study concluded that the incubation period, larval period, pre pupal period, pupal period, adult male and female longevity on different diets ranged from 3.17 - 3.50, 14.00 - 18.50, 4.00 - 6.50, 7.00 - 11.00, 4.50 - 8.00 and 7.00 - 10.33 days, respectively (Table-2). The total life cycle of male and female of *S. frugiperda* ranged from 36.33 - 44.50 and 38.33 - 46.50 days, respectively. Similarly, gram-based diet (diet-2) was found to be better compared with bean based diet (diet-1) for rearing of *S. litura* [8]. On natural food source i.e., maize leaves, the fecundity of *S. frugiperda* was 1064 eggs/female, while incubation period, total larval period, pupal period were recorded to be from 2 - 3, 14 - 19 and 9 - 12 days, respectively. The complete life cycle of male and female was recorded to be 32 - 43 and 34 - 46 days, respectively [9].

Table 2: Biology of fall armyworm, *Spodoptera frugiperda* on different artificial diets

Different diets	Incubation period (days)	Larval period (days)	Pre pupal period (days)	Pupal period (days)	Adult longevity (days)		Total life cycle (egg to adult in days)		Fecundity/ female (number)
					Male	Female	Male	Female	
D ₁	3.17	15.00	4.50	8.00	7.00	10.33	37.67	41.00	1026.67
D ₂	3.33	14.50	4.33	7.33	7.50	10.17	36.99	39.66	1078.33
D ₃	3.50	18.00	6.17	10.50	4.50	7.67	42.67	45.84	840.00
D ₄	3.50	18.50	6.50	11.00	5.00	7.00	44.50	46.50	832.33
D ₅	3.33	14.00	4.00	7.00	8.00	10.00	36.33	38.33	1097.00
SEM+	0.22	0.85	0.51	0.67	0.50	0.68	-	-	7.89
CD 5%	NS	2.67	1.61	2.12	1.57	2.15	-	-	24.89



Fig 1: Laboratory rearing of *S. frugiperda* on different artificial diets

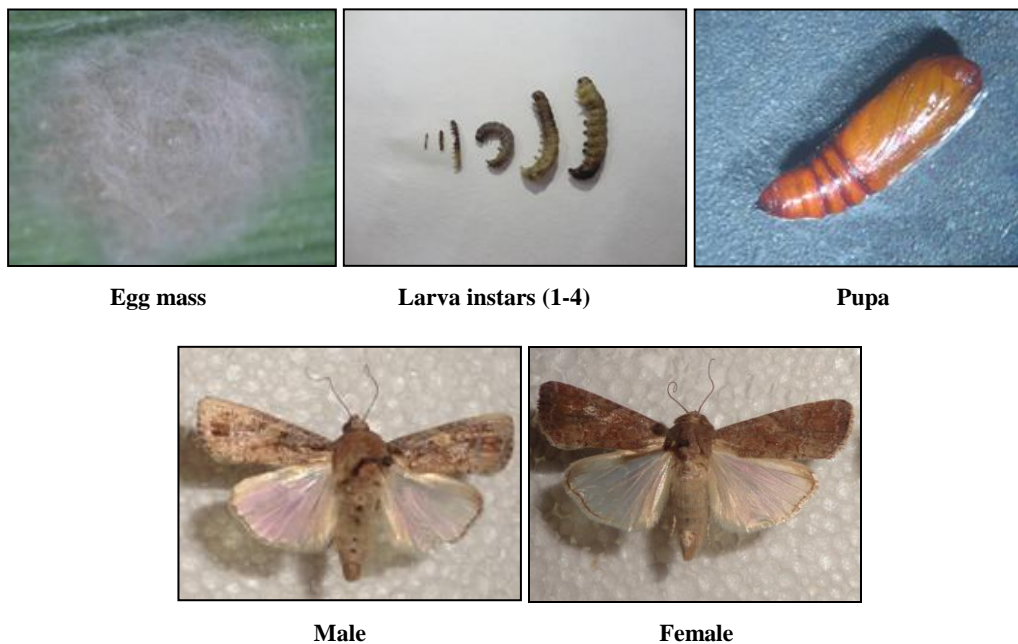


Fig 2: Life cycle of *S. frugiperda*

4. Conclusion

The present biological studies concluded that soybean flour rich artificial diet was found best for laboratory rearing of *S. frugiperda* followed by chickpea and cowpea, whereas, black gram and green gram flour rich diet were found less preferred by pest.

5. Acknowledgments

Authors express sincere thanks to the Head, Department of Entomology; Dean, Rajasthan College of Agriculture and the Director of Research, MPUAT, Udaipur for providing necessary facilities and encouragement.

6. References

1. Luginbill P. The fall armyworm. U.S. Dept. Agric. Tech. Bull. 1928; 34:94.
2. Abrahams P, Beale T, Cock M, Corniani N, Day R, Godwin J *et al.* Fall armyworm status. Impacts and control options in Africa: Preliminary evidence note CABI, UK, 2017. <http://www.Invasive species. Org>.
3. Day R, Abrahams P, Bateman M, Beale T, Clottey V, Cock M *et al.* Fall armyworm: Impacts and implications for Africa. *Outlooks on Pest Management.* 2017; 28:196-201.
4. Goergen G, Lava Kumar P, Sankung BS, Togola A, Tamo M. First report of outbreaks of the fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera, Noctuidae), a new alien invasive pest in West and Central Africa, 2016. <http://journals.plos.org>.
5. FAO. Briefing note on FAO actions on fall armyworm in Africa. Visited on 2nd November, 2017. <http://www.fao.org/emergencies/resources/documents/resourcesdetail/en/c/902985/>.
6. Cock MJW, Beseh PK, Buddie AG, Cafa G, Crozier J. Molecular methods to detect *Spodoptera frugiperda* in Ghana and implications for monitoring the spread of invasive species in developing countries. *Scientific Reports.* 2017; 7:4103.
7. Sharanabasappa, Kalleshwaraswamy CM, Asokan R, Mahadeva Swamy HM, Maruthi MS, Pavithra HB *et al.* First report of the fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae), an alien invasive pest on maize in India. *Pest management in horticultural ecosystems.* 2018; 24:23-29.
8. Ahmad-Ur-Rahman Salijoqi, Riaz ul Haq, Ehsan-ul-Haq, Javed Khan, Ghulam Ali. Rearing of *Spodoptera litura* (Fabricius) on different artificial diets and its parasitisation with *Trichogramma chilonis* (Ishii). 2015; 47:169-175.
9. Sharanabasappa, Kalleshwaraswamy CM, Maruthi MS, Pavithra HB. Biology of invasive fall armyworm *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) on maize. *Indian Journal of Entomology.* 2018; 80:540-543.