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Studies On The Biology Of Chickpea Pod Borer *Helicoverpa Armigera* (Hubner) On Different Types Of Food Materials

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ABSTRACT: Present investigation was carried out on four different diets (Tender chickpea leaf, Chick pea socked grains, Green pea and Artificial diet) for different biological events growth and development were compared as different parameters such as larval period, pre-pupal period, pupal period, percent pupation, pupal weight and percent adult emergence along with embryonic development, eggs laying capacity of female, survivability of adult and sex ratio. The effect of different host on the biological growth and development of pod borer maximum larval period was recorded on green pea 19.43 days, pre-pupal period 1.76 and 1.43 days found on chickpea leaf and green pea than maximum pupal period 12.8 and 10.18 days recorded on same host. The maximum percent of pupation recorded on chickpea leaves 93.33% and on the same host highest adult emergence observed on 90.28%The maximum pre-ovipostional, ovipostional and post-ovipostional periods recorded on artificial diet 3.80, 6.16 and 2.19 days, highest fecundity recorded on artificial diet 770.59 eggs/female, the highest longevity of male and female recorded on chickpea leaf 7.86 and 13.13 days, the maximum sex ratio recorded 1:1.9 on artificial diet .The maximum growth index recorded on artificial diet 5.39 , the higher larval pupal Index and survival index recorded 1.19 and 1.05 on the chickpea leaf ,The maximum ovipostional index recorded on the artificial diet 1.00 ,The adult index of male recorded 1.00 same are all food material and female maximum recorded 1.00 on artificial diet and minimum 0.78 on chickpea grain.

Key words: Biology, Pod borer, artificial diet, Fecundity and ovipostional index

1. INTRODUCTION:

Bengal gram is the world's second most widely grown pulse crop belonging to the family Fabaceae. In the world India acquire first position in production and its consumption. In the developing countries Pulse have valuable nutritional role in the diet of millions of people act as the poor man's meat **(Merga and Haji, 2019**). It is multipurpose utilization directly as food or in different processed forms or as feed in many farming systems **(Kumar and Deb, 2014).** Bengal gram is excellent source of energy by provide rich in vitamins, fiber, mineral, proteins and having potentially health-beneficial phyto chemicals for stomach problem include reducing cardiovascular, diabetic, and cancer risks. **(Wood and Grusak, 2007).** It is mostly consumed in from a whole seed (boiled), decorated split cotyledons, dhal flour (besan) or some other product. It is useful in crop rotation with cereals for improving soil fertility through nitrogen fixation but its production has been decrease in last few years therefore here needs to research and find out constraint behind it in developing country. (Siddique et al., 2000) it is valuable due to high level of protein 40% of its weight. Moreover, the grain chickpea legume crop has potential health benefits, Pulses are cultivated across the Country with the maximum share coming from M.P. (24%), U.P. (16%), MH (14%), A.P. (10%), Karnataka (7%), and Rajasthan (6%). These states are contributing near about 77% of the total pulses production, while remaining 23% is contributed by Gujarat, Chhattisgarh, Bihar, Orissa and other state (Singh *et. al.,* 2018). Chickpea is grain legumes grown mainly in areas with temperate and semiarid climate. (Muehlbauer, and Sarker, 2017).it is accounted for more than 43% (7.o6 mt) of the total pulses production and production of (16.35 mt) in India and nearby 85% of the total pulse exports from 2015 to 2016 (Srivastava *et. al.,* 2017).

Helicoverpa armigera is a prolific, widespread pest, feed on at least 180 plant species, spread across 47 botanical families *(*Kumar *et.al.* 2017) it is highly destructive phytophagous pest of many agricultural crops, like chickpea, cotton, pigeonpea, tomato, sorghum and cowpea also on groundnut, okra, peas, field beans and soybeans (Pimparkar *et.al.* 2017 & Subramanian *et.al.*2006) It is highly polyphagous pest, feeding on leaves, buds, flowers and young pods of the growing crop. Due to polyphagous, multi voltine, migratory behavior, high egg laying capacity easily developed resistance against available insecticidal doses, its became a difficult pest for management. (Sarwar *et.al.*2009) *H. armigera* moth has pale reddish-brown with a prominent dot near the middle of the forewing. A larva has different colors ranging from green, brown or yellowing. (Zahid et.al.2008) The mode of observation for *H. armigera* are the ETL (3 eggs or 2 larvae/plant) regular weekly recorded selected plat of gram pod borer population was done from 50% flowering till harvesting in the experimental field (Gautam *et.al*.2018) The global climate change signifies increase in average temp, change in rainfall pattern and enormous climatic events. These seasonal and long term variations wound influence morphology of plant and insect-pests population dynamics. Different climatic conditions show direct impact on population dynamics of insect-pests due to inflection of mass multiplication, survival, fecundity, voltinism and migration. Intercropping may be a realistic application of ecological ideals based on biodiversity, biotic interaction and other natural regulation mechanisms permitting efficient insect-pest management with low reliance on off farm inputs. The impact of abiotic factors on population dynamics of lepidopteran insect the average Mini. Temp., Max. Temp., Mini. RH, Max. RH and Rainfall. (Bhamare *et.al.* 2018) This pest act as dangerous due to its attack occurred on developing pods, larje quantity of food consumption feeding, quickly movable from infested field, fecundity and Multivoltine short lifespan (Sarode, 1999) Moreover, laboratory rearing using synthetic diets is a better option for knowing its biology under controlled conditions.

2. MATERIAL AND METHODS

Research work conducted in the Domain of Entomology, School of Agriculture, L.P.U, Phagwara, Punjab with laboratory temperature 27-31^{0}C and Relative humidity was 60-80% available photoperiod was 14:10 (L:D) hours. The experiments were conduct in Complete Randomized Design with three replications. Selection and preparation of food materials**:** Three types of food material were selected for this experiment 1.Tender chickpea leaf.2. Chick pea socked grain in water for 24 hours 3.Green pea. 4. Artificial diet prepared format given by **Prasad et.al.,(2008)**

Preparation of artificial diet: Artificial diet for pod borer was prepared three steps given below

Steps-1 Preparation of mixture A: The following ingredients were mixed up 390ml of water: 105 gm chickpea basan+2gm Methyl Para Hydroxy Benzoate+1gm Sorbic acid +0.25 gm streptomycin +2ml of 10 %formaldehyde. This combination was mixed thoroughly in a blender for two minute

Step-II Preparation of mixture B : Boiled Agar-Agar 12.75 gm in 390ml of water this gave mixture B.

Step-III: Mixture A and B were combined and blended for 1Minute and then 10gm yeast +4gm Ascorbic acid +2 multiple vitamin capsule+2 Vitamin E capsules were added and was mixed again by using a blender for 1minute. This provided artificial diet was poured in flat tray and Small Square were cut by knife and the diet was ready to carry out the experiment. For maintaining the culture of this experiment adults and Fresh caterpillar of *H. armigera* were collected from unsprayed field of chickpea crop and kept inside insect rearing cage by covering muslin cloth. 5 pairs of adult were released in each cage by providing 10% sugar solution soaked in cotton swab and the adult were allowed for eggs laying purpose. The deposited eggs on muslin cloth were collected with the help of moist camel hair brush then transfer for study of next stage in their life cycle.

The newly hatched eggs in to neonatal caterpillar transfer with the help of soft moist hairs brush on chickpea socked grains and tender leaf of chick pea. The food material placed on moist filter paper kept inside petri dishes (13cm Diameter) newly hatched larvae appear like extremely small size thread like body with small doted black head. These newly hatched larvae were transferred to another petri plates having four type different diets. In the experiment each diet replicate three time having 5 newly hatch larvae in each replication. Form the second instar onward when larvae grew in size (6-9mm long) the larvae were reared in separate petri plate to avoid cannibalism and provided with different type of food material. The host food materials and petri plates were exchange each and every morning. Caterpillars in each instar stages were studies for their morphological parameter like color, shape and size. An observation on total caterpillar development was recorded separately. Larval period was calculated from the date of hatching of egg to end of six instar. At the stage final instar full growth get stopped, feeding get reduced, turned darker, sluggish and integument got wrinkled appear as pre-pupal stage and final transfer in to pupal stage kept in separate plastic jar having autoclaved sand at bottom for pupation the pupae were identified for different sexes by observing the distance between the genital pore and anal pore. Pupae were change colour from dark to brown color, 14-22mm in length and 4.5-6.5 mm width. Body got rounded at both sides anterior and posterior, with two parallel tapering spines at the tip posterior region. Pupation of this pest occurred in soil.

After adult emergence adult moth form each pupae leaves an empty, thin, and papery brown shell called puparium of pod borer. These adult moths were transferred to another of 15x20 cm insect rearing cage. It was used as oviposition chamber. Opening of container was tied with muslin cloth. Adults were differentiated on the basis of morphological characters in different sexes like colour and abdominal size

Adult typically appearance with stout moth having various color in adult, usually males were yellowish-brown, pale yellow, and female's orange-brown. Meso thorasic wings have a black or dark brown kidney-shaped marking near the center. Meta thorasic were creamy white with a dark brown or gray band developed on outer margin. Pair of newly emerged adult moths released in rearing chamber for collection data on embryonic development. Absorbent cotton dipped in 10 % honey comb provided as food for the adult moths to avoid shortening of adult longevity. Minute greenish colourd eggs were seen at the inner surface of the cloth about 2 nd and 4th day. Eggs were collected daily with the help of soft moist hair brush to find out longevity of female. The pre-oviposition period was calculated from the date of mating of female and the date of starting of egg lying. Oviposition period was calculated from the date of starting of egg lying to the date of cessation of egg lying by the female moth. Post-oviposition period was calculated from the date of cessation egg lying to the date of death of female moth.

Deposited eggs by female recorded daily till the death for find out fecundity of the test insect. The eggs laid the female reared on different type of food material for study were observed under a microscope for their morphological characters colour, shape and size. Eggs deliberated as hatched when tiny young ones came out from it. Hatching percentage was calculated from the number of eggs hatched out from total number of eggs kept under observation. The longevity of adults was calculated separately for male and female from the date of emergence from pupae till death. The effect of the host plant on moulting, larval period, Prepupal period, percentage of prepupation, pupal period, Percent of Adult emergence, fecundity, adult longevity were observed and statistically analyzed by using the following formula as prescribed by **Shanower et.al.,(1997)**

$$\text{Growth index} = \frac{\textit{Percent population}}{\textit{larval period}}$$

$$\text{Larval pupal index} = \frac{\text{Av.larval period(days) onstandard food material}}{\textit{Av.larval period (days) on test food material}}$$

$$\text{Pupal weight index} = \frac{\text{Av. pupal weight(mg) onstandard food material}}{\textit{Av. pupal weight (mg) on test food material}}$$

$$\text{Adult index} = \frac{\text{Av. adult (male/female) longivity on test food material}}{\textit{Av. adult (male/female) longivity on standard food material}}$$

$$\text{Survial index} = \frac{\textit{No.of adult emerged from the same number of larvae on test food material}}{\textit{No.of adult emerged from the same number of larvae on standard food material}}$$

$$\text{Ovipostional index} = \frac{\textit{Number of eggs laid by adult emerged from the larvae on test food material}}{\textit{Av. number of adult emerged from the same number of larvae on standard food material}}$$

Statistics analysis: Experiment carried out in CRD. Observations were recorded in lab from starting of each experiment separately subjected to square root transformation prior to analysis as for normalized the data. Necessary analysis like ANOVA and correlation was done by SPSS of statistical methods.

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Experimental Findings:

In the present investigation, pod borer *H. armigera,* is a highly phytophagous pest of many agricultural crops. Here, we reared it on different food material such as chickpea grain, chickpea leaf, green pea and artificial diet.

Embryonic development:

The Pre-oviposition period of adult moth was data conducted with longer period 3.80 and 3.09 days feed on the artificial diet and chickpea grain. Here, the lowest period data noticed as 2.10 and 2.06 days when larvae feed on the chickpea leaf and green pea. Similarly, the oviposition period was data observed on the higher period 6.16 days when larvae feed on the artificial diet, respectively followed by 5.56 days larvae feed on the chickpea grain and as well as 5.04 days larvae feed on the green pea

However, observed was shortest period with 4.06 days when larvae was feed on the chickpea leaf. Likewise, the post- oviposition period of *Helicoverpa armigera* was data conducted with longer periods 2.19 and 2.07 days when larvae feed on the artificial diet and chickpea grain. However, the lowest period's data was observed as 1.11 and 1.06 days when *Helicoverpa armigera* feed on the green pea and chickpea leaves, respectively. Table- 1

Table 1: Effect of different food material on pre-oviposition, oviposition, post-oviposition periods, fecundity, longevity (M/F) and sex ratio of *Helicoverpa armigera*

Food material	Pre oviposition period (Days)	Oviposition Period (Days)	Post oviposition Period (Day)	Fecundity (egg/female)	Longevity (Days)		Sex Ratio (M:F)
					Male	Female	
Chickpea grain	3.09	5.56	2.07	760.68	7.49	11.54	1:1.5
Chickpea leaf	2.10	4.06	1.06	696.05	7.86	13.13	1:1.8
Green pea	2.06	5.04	1.11	752.31	7.51	11.13	1:1.7
Artificial diet	3.80	6.16	2.19	770.59	7.80	12.29	1:1.9
SEm	0.14	0.05	0.01	---	---	---	--
CD(P=0.05)	0.48	0.16	0.05	16.83	0.31	0.54	--

Fecundity :Data conducted on number of eggs laid per female *Helicoverpa armigera* were establish highest fecundity feed on the artificial diet (770.59 eggs/female), respectively followed by 760.68 eggs/female feed on the chickpea grain and with the 752.31 eggs/female feed on the green pea. Likewise, lowest fecundity on *Helicoverpa armigera* has recorded when larvae feed on the chickpea fresh leaf with the 696.05 eggs/female (Table-1).

Sex ratio: Observation recorded considering the impact of different larval foods on the sex ratio of *Helicoverpa armigera*, it was apparent that population of females outnumbered the male in all four treatments such as chickpea grain, chickpea leaf, green pea and artificial diet. The maximum sex ratio of 1:1.9 was recorded with larvae feed on the artificial diet respectively, followed by 1:1.8, 1:1.7 and 1:1.5 with chickpea leaf, green pea and chickpea grain(Table-1).

Larval periods:The outcomes results revealed the growth and development parameters of larvae on four different diets under laboratory conditions. Here, average longest larval period of 19.43 days was reported when the larvae were fed on green pea, followed by 18.91 days on chickpea leaf, 17.94 days on chickpea grains, respectively. The shortest larval period of 16.06 days was observed when artificial diet was fed to larvae. (Table-2)

Pre-pupal and pupal period :Reported was longest averaged of pre-pupal period of 1.76 days was attained on chickpea leaf, followed by 1.43 days on green pea and 1.16 days on chickpea grain. The shortest pre-pupal period of 1.14 days was observed when larvae feed on artificial diet. Similarly, the pupal period was also found to be longest period 12.08 days on chickpea leaf, followed by 10.82 days on chickpea grain and 10.18 days on green pea. The shortest pupal period of 9.82 days was conducted when *Helicoverpa armigera* feed on artificial diet. (Table-2)

Pupal and adult emergence percent: Chickpea was observed as the most favorable food with the maximum average of pupal percent of 93.33% respectively, followed by 86.66% on artificial food and 83.33% on green pea. The average percent of pupal was observed minimum 80% larvae feed on chickpea grains. Likewise, there was maximum adult emergence of 93.28% noticed when the larvae of pod borer feed on chickpea leaf, following by 85.33% feed on chickpea grain and same as 85.23% adult emergence larvae feed with artificial food. Here, the minimum average percent of 81.25% adult emergence was reported when the larvae were fed on green peas (Table-2).

Table 2: Effect of different Host on the growth and development of *Helicoverpa armigera*

Food material	Duration of larval instar (days)						Larva Period	Pre-pupal period (Days)	Pupal period (Days)	Percent Pupation (%)	Percent Adult Emergence (%)
	I	II	III	IV	V	VI					
Chickpea grain	3.14 (3.12-3.17)	3.16 (3.06-3.24)	3.19 (3.15-3.24)	2.22 (2.20-2.24)	2.06 (2.03-2.09)	4.16 (4.13-4.19)	17.94 (17.69-18.17)	1.16 (1.12-1.23)	10.82 (10.22-11.18)	80.00	85.33
Chickpea leaf	2.88 (2.23-3.22)	3.08 (3.06-3.12)	2.18 (2.15-2.21)	3.45 (3.15-4.02)	3.49 (3.16-4.10)	3.81 (3.22-4.13)	18.91 (16.97-20.08)	1.76 (1.22-2.05)	12.08 (11.08-13.06)	93.33	90.28
Green pea	2.79 (2.23-3.10)	2.81 (2.21-3.18)	3.44 (3.12-4.08)	3.77 (3.10-4.13)	3.09 (2.12-4.02)	3.50 (3.18-4.12)	19.43 (15.96-22.63)	1.43 (1.10-2.02)	10.18 (9.18-11.16)	83.33	81.25
Artificial diet	2.47 (2.13-3.10)	2.85 (2.20-3.20)	3.78 (3.18-4.12)	2.10 (2.05-2.21)	2.06 (2.03-2.08)	2.79 (2.20-3.11)	16.06 (13.79-18.82)	1.14 (1.10-1.18)	9.82 (9.20-10.15)	86.66	85.23
SEm	0.26	0.22	0.22	0.22	0.31	0.26	0.32	0.20	0.45	4.08	1.79
CD (P=0.05)	---	---	0.72	0.73	1.04	0.86	---	---	1.52	---	5.94

Growth indices values on different food material

The data reported in the table indicated that the maximum growth index of 5.39 was recorded when larvae feed on the artificial diet respectively, followed by 4.93 feed on the chickpea leaf as well as 4.28 feed on the green pea. Whereas the minimum growth index of 4.01 was observed with larvae feed on the chickpea grain (Table-9). The maximum larval pupal indices 1.19 feed on chickpea leaf followed by 1.14 on green pea and 1.11 on chickpea grain respectively, whereas the minimum larval pupal indices 1.00 on artificial diet. Survival index values shows that all treatments except chickpea leaf (1.05, respectively) followed by chickpea grain and artificial diet with the same values 1.00, respectively were of the lower magnitude 0.95 on green pea (Kumar, P. (2019); Kumar, D., Rameshwar, S. D., & Kumar, P. (2019); Dey, S. R., & Kumar, P. (2019); Kumar et al. (2019); Dey, S. R., & Kumar, P. (2019); Kumar, P., & Pathak, S. (2018); Kumar, P., & Dwivedi, P. (2018); Kumar, P., & Pathak, S. (2018); Kumar et al.,2018; Kumar, P., & Hemantaranjan, A. (2017); Dwivedi, P., & Prasann, K. (2016). Kumar, P. (2014); Kumar, P. (2013); Kumar et al. (2013); Prasann, K. (2012); Kumar et al. (2011); Kumar et al. (2014). Considering the reported was about ovipostional and adult index (M: F) which shows that artificial 1.00 and other one was of lower magnitude than the unity (Table-3).

Table 3: Growth indices of *Helicoverpa armigera* on different hosts

Food material	Growth Index	Larval pupal Index	Survival index	Ovipostional index	Adult Index	
					Male	Female
Chickpea grain	4.01	1.11	1.00	0.98	1.00	0.78
Chickpea leaf	4.93	1.19	1.05	0.90	1.00	0.94
Green pea	4.28	1.14	0.95	0.97	1.00	0.89
Artificial diet	5.39	1.00	1.00	1.00	1.00	1.00
SEm	0.91					
CD(P=0.05)	----					

3. DISCUSSION:

The effect of different hosts on the growth and development of pod borer maximum larvae duration was recorded on green pea 19.43 days followed by chickpea leaf 18.91days and pre-pupal period 1.76 and 1.43 days found on chickpea leaf and green pea than maximum pupal period 12.8 and 10.18 days recorded on same host. These results are in conformity with the recent of **Kumar *et.al.*2017** who observed 15.53 and 11.27 days of larval periods of *Helicoverpa armigera* on chickpea and artificial diet, respectively. **Singh *et.al*.2019** who observed those 18.57 and 19.30 days larval periods of *Helicoverpa armigera* on pea and chickpea leaves. **Hamed *et.al.*2008** who reported 15.6 and 14.5 days larval periods of pod borer chickpea leaves/pods and chickpea flour. **Kumar *et.al.*2018** studies on the chickpea leaves & pod of *Helicoverpa armigera* larval periods in 14.68 days.

In my findings maximum percent of pupation recorded on chickpea leaf followed by artificial diet 93.33% and 86.66% simultaneously supported by Earlier, **Kumar *et.al*.2017** observed shortest pupal period of *Helicoverpa armigera* to the extent of 9.53 days on artificial diet followed by pea (10.31 days) and chickpea grain (10.78days). **Singh *et.al*. 2019** on the contrary conducted shortest pupal period of 13.47 days on chickpea followed by chickpea leaves 15.37 days. **Amer *et.al.*2014** observed that 11.00 days of pupal period of *Helicoverpa armigera* on pea and artificial diet. **Hamed *et.al*.2008** and **Kumar *et.al*.2018** reported 14.6 and 10.28 days of pupal periods of pod borer on chickpea leaves. These results were in conformation with the work of **Kumar *et.al*.2017** who observed percent pupation in *Helicoverpa armigera* on chickpea grain, chickpea leaf and artificial diet with 85.67%, 78.24% and 91.86%. Singh *et.al*.2018 reported that 91.67% and 77.14% pupation of pea and chickpea leaf. **Amer *et.al*.2014** also observed percent pupation of pod borer on pea and artificial diet with 91.64% and 91.00%. **Hamed *et.al*.2008 and Kumar *et.al*.2018** reported that 80.1% and 77.73% of percent pupation on chickpea leaf.

The highest percent of adult emergence recorded on chickpea leaf and chickpea grain 90.28% and 85.33%.The maximum pre-ovipostional, ovipostional and post-ovipostional periods recorded on artificial diet 3.80, 6.16 and 2.19 days and lowest 2.06 days recorded on green pea, 4.06 and 1.06 days on chickpea leaf this findings supported by **Kumar *et.al*.2017** also reported highest adult emergence of *Helicoverpa armigera* 83.46% on artificial diet, respectively followed by 81.87% larvae feed on chickpea grain and 75.40% feed on pea. **Singh *et.al*.2019** who observed 85.45% and 77.14% adult emergence of pod borer larvae feed on pea and chickpea leaf. **Amer *et.al.*2014** reported highest adult emergence 92.73 of *Helicoverpa armigera* on artificial diet followed by 90.57% feed on pea. **Hamed *et.al*.2008 and Kumar *et.al*.2018** conducted 83.1% and 71.01% adult emergence of pod borer feed on the chickpea leaf.

The highest fecundity recorded on artificial diet 770.59 eggs/female and lowest 696.05 recorded on chickpea leaf. The highest longevity of male and female recorded on chickpea leaf 7.86 and 13.13 days and minimum longevity of male 7.49 days recorded on chickpea grain and female recorded 11.13 days on green pea. Highest fecundity in *H. armigera* has been also reported by **Kumar *et.al*.2017** when the larva was feed on artificial diet 784.66egg/female respectively, followed by 744.33egg/female feed on pea. Kumar *et.al*.2018 reported adult emergence 386.70egg/female of *Helicoverpa armigera* feed on chickpea leaf. **Ali *et.al*.2009** observed adult emergence 413.00egg/female of pod borer feed on chickpea.

The maximum sex ratio recorded 1:1.9 on artificial diet and minimum recorded with 1:1.5 on the chickpea grain. The maximum growth index recorded on artificial diet 5.39 and minimum growth index recorded on chickpea grain 4.04. This findings are in accordance with **Kumar *et.al*.2017** also reported highest sex ratio on artificial diet respectively, followed by when larvae feed on chickpea grain. **Kumar *et.al*.2018** however, reported 1:1.51 sex ratio of female in the population of pod borer feed on chickpea leaf. The higher larval pupal Index and survival index recorded 1.19 and 1.05 on the chickpea leaf and minimum larval pupal index recorded on the artificial diet with 1.00 and lowest survival index recorded 0.95 on the green pea (ChitraMani & Kumar, P. (2020); Sharma, M., & Kumar, P. (2020); Chand, J., & Kumar, P. (2020); Naik, M., & Kumar, P. (2020); Kumar, P., & Naik, M. (2020); Kumar, P., & Dwivedi, P. (2020). Devi, P., & Kumar, P. (2020); Kumari, P., & Kumar, P. (2020); Kaur, S., & Kumar, P. (2020); Devi, P., & Kumar, P. (2020); Sharma, K., & Kumar, P. (2020); Kumar, S. B. P. (2020); Devi, P., & Kumar, P. (2020); Chand, J., & Kumar, P. (2020). The maximum ovipostional index recorded on the artificial diet 1.00 and minimum 0.90 on the chickpea leaf. The adult index of male recorded 1.00 same are all food material and female maximum recorded 1.00 on artificial diet and minimum 0.78 on chickpea grain this findings supported by **Kumar *et.al.* 2018** chickpea leaves & pods (control) conducted with 2.735. **Kumar *et.al.* 2017** the higher growth index of 8.14 was conducted on artificial diet followed by chickpea (5.49) and pea (5.39) larval pupal, survival and ovipostional index which show that except chickpea grain and artificial (1.000 and 1.261, 1.012 and 1.015) **Kumar *et.al.* 2018** chickpea leaves & pods (control) conducted larval pupal, survival and ovipostional index with (1.000, 1.066 and 1.077)

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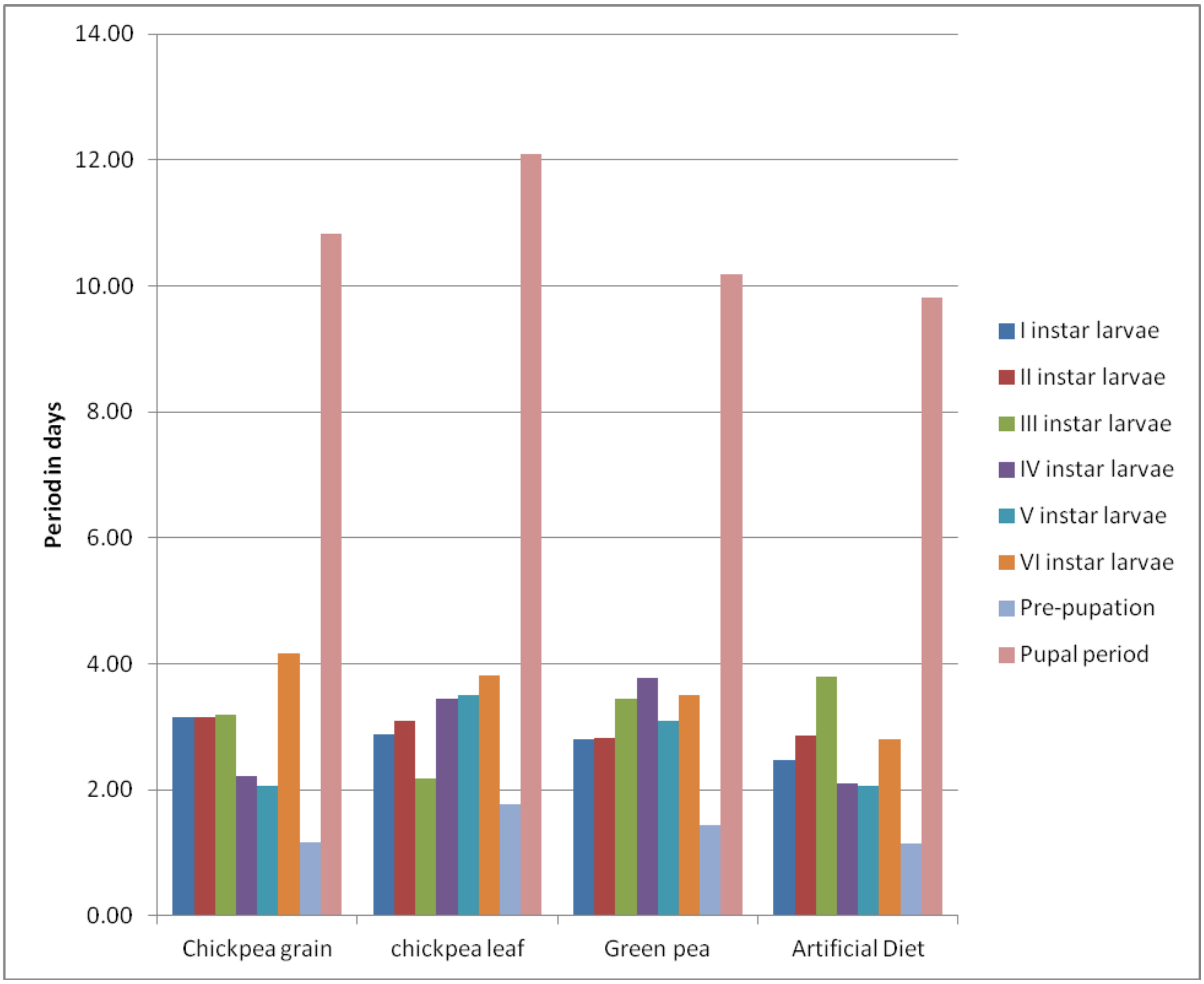

Fig 1: Graphical representation of different Host effect on the growth and development of *Helicoverpa armigera*

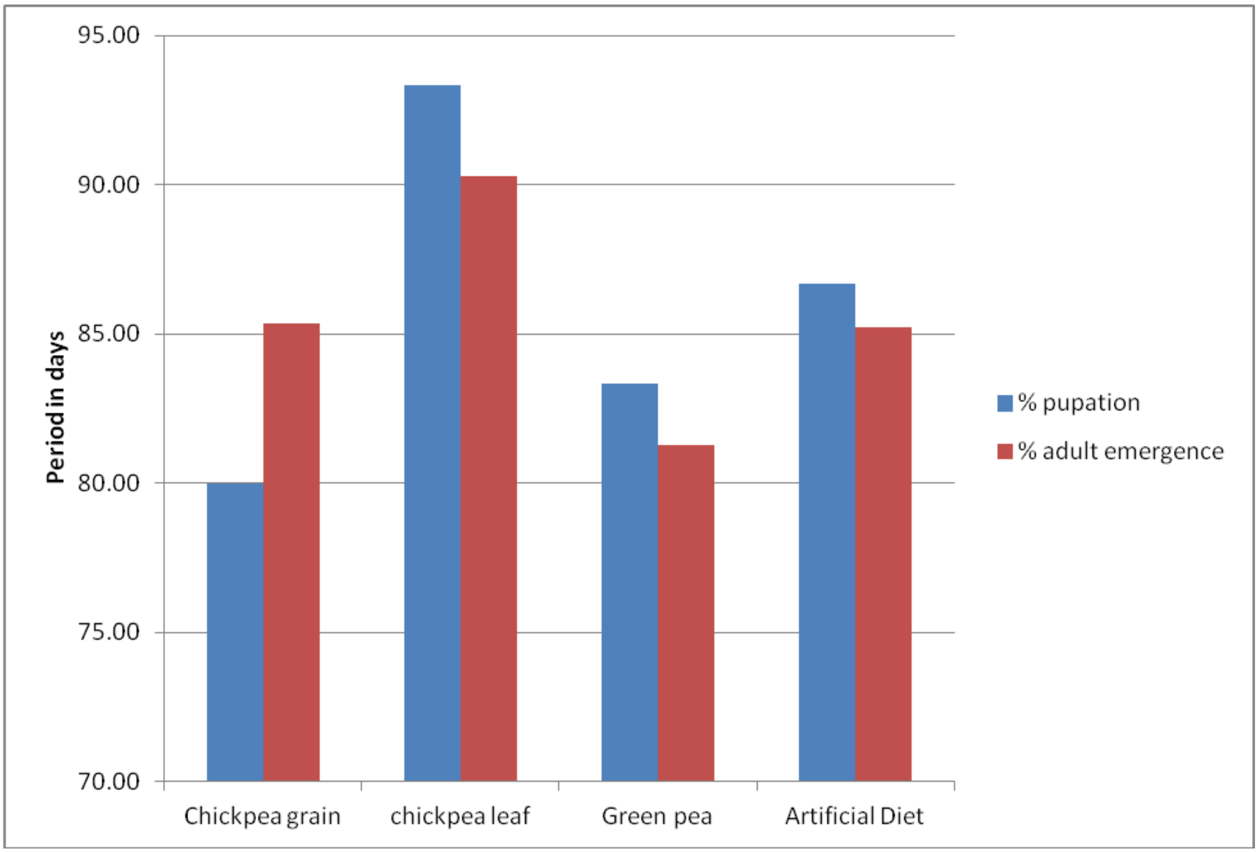

Fig 2: Graphical representation of Percent Pupation and adult emergence 2018-19.

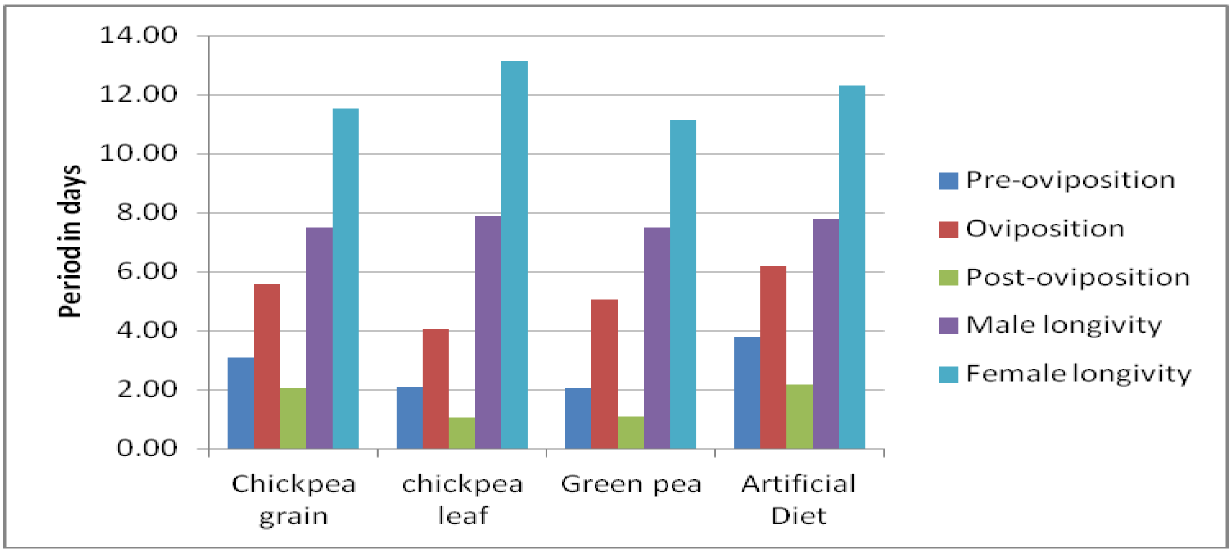

Fig 3: Graphical representation of different food material effect on pre-oviposition, oviposition, post-oviposition periods and longevity (M/F) of *Helicoverpa armigera*

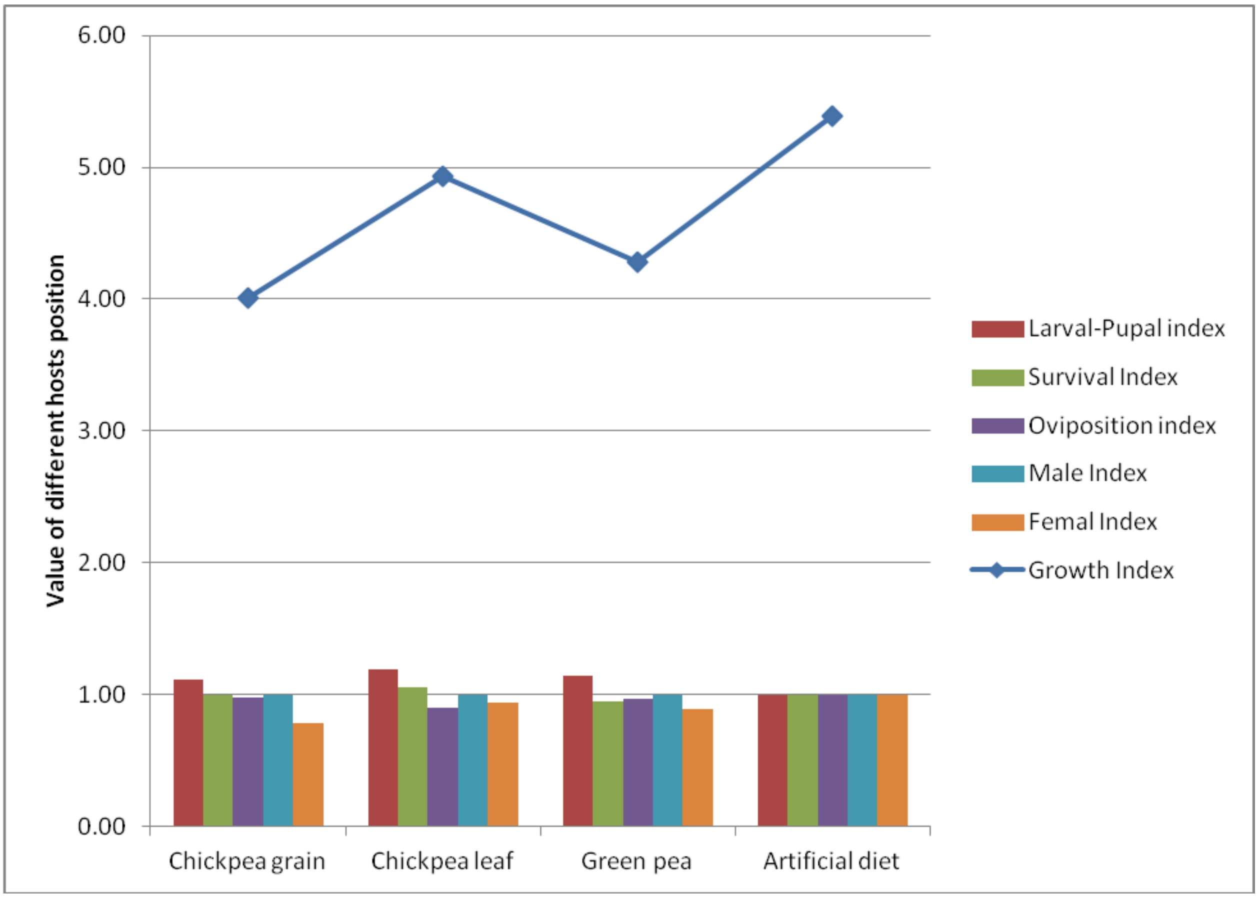

Fig 4: Graphical representation Growth indices of *Helicoverpa armigera* on different hosts