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RESEARCH ARTICLE

INFLUENCE OF TEMPERATURE&RELATIVE HUMIDITY ON THE SURVIVAL OF *Daphnis nerii* (LEPIDOPTERA: SPHINGIDIAE) AND ITS FOOD EFFICACY ON HOST PLANTIN ARID AND SEMI-ARID REGION.

Anchal Sharma and Dr. S. I. Ahmed.
Arid Forest Research Institute, Jodhpur.

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Abstract

Arid region is characterized by high temperature and high evaporative demand that has made survival of insects difficult**.** The lepidopterous fauna of India with particular reference to arid and semi-arid region is relatively diverse and has received a very little attention by the scientists. The knowledge of food efficacy oflepidoperous species in a particular ecosystem, pertaining to their life-stages and effect of abiotic factors, is essentially required for their effective conservation.

Lepidoptera normally feed on horticultural plants. The *Daphnis nerii* is a lepidopterous moth usually found on the host plant *Nerium oleander*. They defoliate the leaves,leaving veins and veinlets. An experiment has been laid down in the lab as well as in field condition, where*Nerium* leaves were provided to starving fifth instarslarvae of *D. nerii* and the food efficacywere evaluated. The coefficient of digestibility (C.D.), the efficiency of conversion of ingested food to the body weight (E.C.I.) and the efficiency of conversion of digested food (E.C.D.) of *D. nerii*larvae, fed on the leaves of *Nerium oleander* were recorded as 80.43%, 13.21%, 15.01% respectively. The *Nerium oleander* is found as a most suitable host plant for the rearing of *D. nerii* .There are 4 to 5 overlapping generations in a year. There are fiveinstar larvae. The incubation period is about 25 to 28 days. The pupal periodlasts for 20 days.

The influence of abiotic factor like temperature and relative humidity on the survival of *D. nerii*has been studied. The most suitable period for *D. nerii* is from August to October with temperature ranges from $25^{o}$to 30^{o}C and relative humidity ranges from 55 to 60 %.

Introduction:-

Hawkmoths (Sphingidae) are one of the few lepidopteran groups to have been well inventoried and documented on every continent (Kitching and Cadiou 2000). Backed by a wealth of information and their biology, life histories, and morphology, theSphingidae have played significant roles in a varietyof research programs. Examples include pollinationbiology (Inoue 1986, Kato et al. 1991,Willmott and Burquez 1996, Maad 2000, Ando *etal*., 2001), biogeography (Holloway 1983) and conservationbiology (Holloway 1991, Kitching 1996).The sphingid fauna of

Corresponding Author:- Anchal Sharma.
Address:- Arid Forest Research Institute, Jodhpur.

India with particular reference to arid and semi-arid region is relatively diverseand has received a very little attention by the scientists.

The single family, Sphingidae is most diverse in tropical regions, but the large, fast-flying moths are familiar insects throughout the world (Daly et al., 1998). Sphingidae is a family of moths commonly known as Hawk Moth, sphinx moths and horn worms that includes about 1,200 species (Grimaldi& Engel, 2005). The hawk moths are medium to large-sized, heavy-bodied moths with characteristics of bulletshapedbodies and long, blade-like wings.

Species of *Daphnis nerii*mainly feedupon oleander *(Nerium oleander).Nerium oleander*is a very toxic plantbut *Daphnis nerii*are immune towards its toxicity. The adults feed on nectar of a variety of fragrant flowers like petunia, jasmine and honeysuckle. They are active in the night time, visiting the flowers after the sunset.They are common throughout the year; the monsoon season brings the increase in their population size. Summer month were the quiescent period of the reproductionof *Daphnis nerii***,** and monsoon season promotes the reproduction activity, westudied in detail (i) life history length (ii) Population index and the rate of development of life stages of *Daphnis nerii*. This knowledge is usefulin the conservation management of the Lepidoptera: moth.Adults of *Daphnis nerii*breed throughout the year. Due to its habit as a strong flier, *D. nerii*, has been observed to have been migrated from one region to the other within a short span of time. The adult moth is one of the most beautiful patterned moths in the arid ecosystem. The studies were conducted during from 2010 -2011.

The rate of development of insects has a strong nutritional component. Food intake by larvae, as well as the quantity of food ingested, affects growth rate, development time, final body weight and survival (Slansky&Scriber, 1985). The larval instars are prolonged and the relative growth rate of insects is reduced (Carvalho, 1996). Besides an adequate level of ingestion of nutrients, assimilation and conversion of food into energy and biomass are also related to insect growth (Reese, 1978). The assimilation of ingested food (digestibility), as well as the ability to convert ingested and digested food into growth, was evaluated by means of bi-coordinate plots (utilization plots) associated with analyses of covariance developed by Raubenheimer&simpson (1992, 1994).

Temperature is the most important environmental factor affecting poikilotherms and has a pervasive effect on physiological processes and on almost all aspects of organism's performance. Growth of caterpillars is strongly temperature dependent (Sharpe and DeMichele, 1977; Scriber &Slansky, 1981) and the degree of temperature dependence varies from species to species and optimal temperature for growth is also variable (Taylor, 1981).

The temperature- dependent developmental rate curve of an insect is an important feature of its life history (Taylor, 1981). Using degree – day accumulation to predict a wide variety of events such as egg hatch, adult emergence, or migratory flights may be feasible for pest management. Degree day accumulation needs knowledge of both insect developmental response to temperature and lower developmental threshold (Woodson and Jackson, 1996).

Material and Methods:-

An extensive collection of larvae of *D. nerii*were made from*Nerium oleander* plants in and around Jodhpur, by hand during the course of these investigations. The larvae were brought to the Entomology laboratory in Arid Forest Research Institute, Jodhpur in small fine meshed wooden cages (20 x 20 x 15 cm.). The larvae were sorted out in laboratory and only those measuring about 80-85 mm (final instars)were utilized for investigation. The test larvae were starved for a period of 24 hours in order to prevent excretory deposition on excrementitiously filaments. The larvae were kept at 28°C □ □ 2°C temperature and 56.0 % relative humidity.Whatever excretory matters was given out during this period, the same was removed and discarded. After 24 hours three batches of 10 larvae each were weighed and supplied with about 87.328 gm. (net weight) of *N. oleander* and allow feed on them for 24 hours. After this period food was withdrawn. Excrementations matter produced subsequent to feeding was collected and its wet weight was determined. The weight of larvae was also recorded to determine gain in weight during the 24 hours period. The unconsumed leaves were weighed to find out the amount of leaf matter consumed.

The coefficient of digestibility (*C.D.*) was calculated as:
C.D. = Dry wt. of food ingested- Dry wt. of excreta X 100
Dry wt. of food ingested

The efficiency of conversion of ingested food to body wt. (*E. C. I.*) is measure of the overall ability of an animal to grow on a given food. It was calculated as:

E.C.I. = Dry wt. gained by animal X 100

Dry wt. of food ingested

The efficiency of conversion of digested food to body wt. (*E. C. D.*) is calculated as:

E.C.D. = Dry wt. gained by animal X 100

Dry wt. of food digested

Results and Discussion:-

The period of development from egg toadult emergence spanned over 24 (□ □ 5) days.Theresult obtained on the quantity of food eaten in relation to the gain in the body weight and quantity of excrement of produced is presented in the table 1.

The coefficient of digestibility (*C.D.*), the efficiency of conversion of ingested food to the body weight (*E.C.I.*) and the efficiency of conversion of digested food (*E.C.D.*) of *D. nerii*larvae, fed on the leaves of *Nerium oleander* were recorded as 80.43%, 13.21%, 15.01% respectively.

Table 1:- Food eaten in relation to the gain in the body weight

S.No.	Particulars	values
1.	Fresh Weight of leaves provided to batch of 10 larvae (gm.)	87.328
2.	Dry weight of leaves provided to batch of 10 larvae (gm.)	16.373
3.	Fresh weight of unconsumed leaves (gm.)	54.063
4.	Dry weight of unconsumed leaves (gm.)	09.836
5.	Fresh weight of consumed leaves (gm.)	29.536
6.	Dry weight of consumed leaves (gm.)	5.979
7.	Initial weight of batch of 10 larvae (gm.)	6.8
8.	Final weight of batch of 10 larvae after 24 hours (gm.)	7.59
9.	Weight gained by 10 larvae after 24 hours (gm.)	0.79
10.	Fresh weight of fecal matter excreted during 24 hours (gm.)	2.273
11.	Dry weight of fecal matter excreted during 24 hours (gm.)	1.170
12.	Dry weight of food digested	5.26

The assessment of the Population index and the rate of development of life stages of *Daphnis nerii*in laboratory in relation to Temperature and Relative Humidity indicated that,all the life stages are evident during the entire year, with higher frequency during August – October.Developmentfrom egg hatch to the adult stage occurred at all temperature tested: survival declined above 30^{o}C or below 25^{o}C. There was a decrease in developmental time with increasing temperature for most life stage. The rate of development of these life stages leading to the formation of adults as studied in the laboratory is varies with the change in temperature and humidity as presented in table 2. The extreme of temperature had detrimental effect on immature growth and caused high mortality. The mortality was also caused by unable finishing larval stage, unable pupating or by deformed adults with misshapen wings, common during November – April and less common during May- June. All the life stages are evident during the entire year, with higher frequency during August – October. The rate of development of these life stages leading to the formation of adults as studied in the laboratory is also varies with the change in season, as it is maximum after monsoon season *i.e,* during the month August – October and declines towards the month of May.

Table 2:-Population index and the rate of development of life stages of *Daphnis nerii*during 2010–11 in laboratory in relation to Temperature and Relative Humidity.

Life stage	July 2010	Aug	Sept	Oct	Nov	Dec	Jan 2011	Feb	Mar	April	May	June
	Temp (^{o}C) & R H (%)											
	32.5/ 63	30/ 75	28.7/ 67	28.7/ 43	23.3/ 57	17.5/ 50.5	16.8/ 44.5	20.5/ 49.5	24.7/ 55	25.4/5 7.4	30.5/ 50.2	32/ 60
No. of eggs incubated	30	50	40	45	34	25	20	18	15	16	13	12
No. of larvae hatched	15	25	20	21	15	14	12	12	10	12	9	9
No. of pupae formed	7	16	10	12	5	5	4	4	2	4	2	3
No. of adults emerged	4	6	5	5	3	2	3	2	2	3	1	1

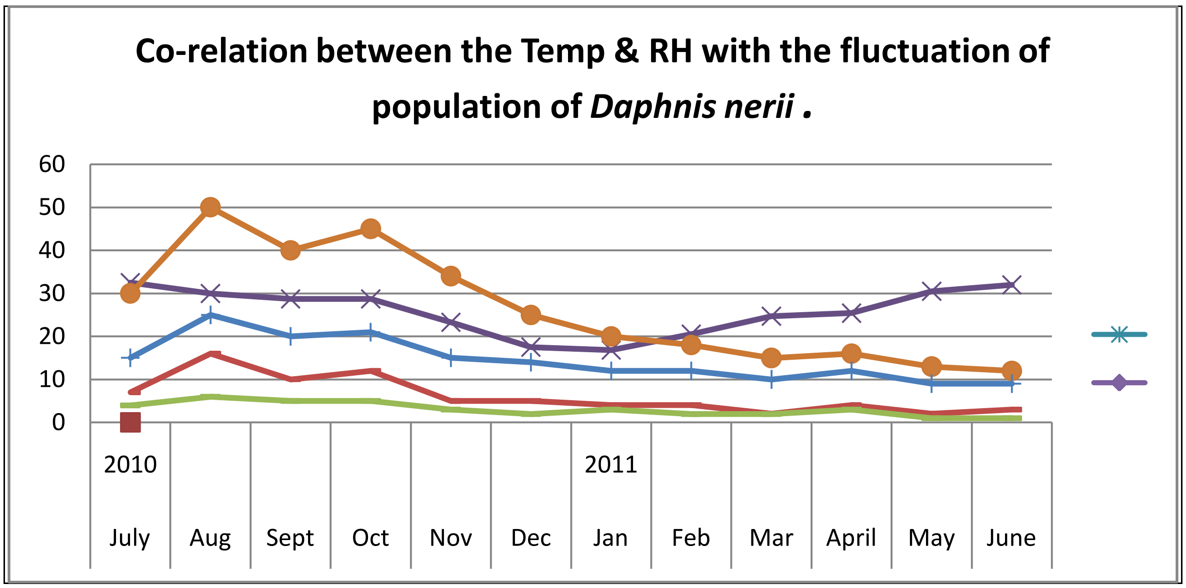

Fig:- Graph showing relationship between Population of *D. nerii* with Temp. and Humidity

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