

Biology of *Cynthia cardui* on *Malva parviflora* in the Cold Arid Soil of Kargil (J&K), India

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Ladakh region consists of two districts namely Kargil and Leh district. Kargil lies in the northern most part of Jammu and Kashmir and bestowed with meagre vegetation despite having a larger area of approx. 14086 km². Various crops and medicinal herbs are obtained from the cold arid soils. *Cynthia cardui* an economically important pest found on *Malva parviflora* which feed voraciously on the leaves of the plant. *Malva parviflora* is a medicinal herb with antioxidant activities. An attempt is made for the first time to study the biology of *Cynthia cardui* in the cold desert of district Kargil. During study it was observed the larval stage exhibits the destructive phase. The different stages of larvae feed on the entire leaves and even the veins and the midribs of the leaf which resulted in skeletization of the leaves and affect the growth and development of the herb.

Keywords: *Cynthia cardui*, cold arid soil, kargil.

The district Kargil (32° 15' to 36° latitude and 75° 15' to 80° 15' longitude) lies at an altitude of 2,704 metre to 5000 metre of Ladakh region in the rain shadow of the Himalaya, where the arid monsoon winds reaches after being deprived of its moisture in high altitudinal plains and the himalayan Mountains. The region comprises of both arctic and desert climate, thus, also known as the "cold desert" characterized by strong flow of winds and enormous seasonal fluctuations in the temperature which ranges from + 35 to -35 with maximum sun shine days and severe cold nights. The soil mainly consists of sand and gravel has low water holding capacity and meagre nutrient status is not very productive. It is one of the driest regions with low rainfall; however, the maximum precipitation is in the form of snow which forms

main source of water for the rivers and streams supporting their livelihood. The traditional crops of the area are barley (*Hordeum vulgare*), grm (*Hordeum aegiceras*), buckwheat (*Fagopyrum tartaricum*), wheat (*Triticum aestivum*), oats (*Avena sativa*) and millets (*Panicum miliaceum*). Some area is also occupied by potato (*Solanum tuberosum*), mustard (*Brassica sp.*) and pea (*Pisum sativum*). In kitchen gardens *Allium cepa*, Knol knol, *Cariandum sativum* are mainly cultivated. The arable land is limited to lower slopes and flat valleys where water accessibility is ensured. The complex variability in the climatic conditions due to limited availability of natural resources along with the extreme high altitude environmental constraints and harsh climatic conditions permit agriculture in suitable niches such as the lower

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slopes and the valleys. The growing period is very short and extends from May – September due to the soil and the climatic conditions. *Malva parviflora* is a perennial herb native to Europe, Asia and Northern Africa and extensively naturalised to other places. It grows erect upto 50cm in height covered with stellate hairs and is woody at the base. The small pink coloured flowers possess long 4-5 mm petals. The leaves are broad with 7-8 cm in diameter having 5-6 lobes. The herb possess large no of common name as cheeseweed, little mallow, Egyptian mallow, small-flowered mallow, marshmallow, small flowered marshmallow. The leaf extract acquire anti-inflammatory action and antioxidant activities. (Bouriche *et al.*, 2011). The painted Lady, *Cynthia cardui*, (Nymphalidae, Lepidoptera) is the most widely distributed butterfly in the world (Opler and Krizek, 1984; Scott, 1986). It is a large butterfly with a wing span 5 – 9 cm identified by the black and white corners of its mainly deep orange, black-spotted wings. The black forewing tips carry five white spots and while the orange part may be pale at random in various places, there are no clean white dots in them. The hind wings bear four small sub marginal eyespots on upper and lower sides. Those on the upper side are black, but in the summer sometimes small blue pupils are present in some. It has a remarkable pattern of flying in a sort of screw form. Habitats are mostly everywhere in the areas secluded with hedgerows, open environments with sunlight brightness and are frequently attracted to open areas of flower gardens. Host plants are mainly herbaceous, but rarely shrubs or trees, and include species from many families. Many plant families like Asteriaceae, Malvaceae etc have been recorded as larval hosts, but thistles (*Cirsium* spp.) seem to be favoured in western Canada (Guppy & Sheppard 2001). It is a polyphagous insect causing damage to the crops and is the serious pest of alfalfa, beans soyabeans and sunflower (William, 1970). *Helianthus annuus*, *Pisum sativum*, *Lupinus albus*, *Medicago sativa* are also infected with this pest (Toth, 1962). The painted lady is a serious pest of artichoke, Egyptian mallow, tomato, lupin, alfa-alfa and rice in Egypt (Hammad *et al.*, 1972). The butterflies are visualised commonly on the *tagetus* plant for their nectar. The migration habit in *Cynthia cardui* has been the topic of interest among many authors as (Abbott, 1951), (Daunreuther,

1953), (Richard South, 1947), (Stefanescu, 1997), (William, 1927) and (Woodbury, 1943). Besides being as significant pest, *Cynthia cardui* gets parasitized by several insects as *Chestogaedia monticola* (Tachnidae) is a normal host to this pest (Severin *et al.*, 1915). The larvae of *Cynthia cardui* is reported to get attacked by *Pelatchina tibialis*, (Tachnidae) (Nielsen, 1918). *Therion Mario* is recorded as a frequent parasite of this pest (Tothill, 1922). In Eritrea (Africa), *Apanteles*, a braconid is reported as a parasite that attacked the larvae of this pest (Jannone, 1948). *Achaetoneura archippivora* was reared from *Cynthia cardui* in Arizona (USA). *Hyposter exiguae* was observed to be a solitary endoparasite of many lepidopterans including *Cynthia cardui* in Southern California (Putler, 1962). The larvae depend on the leaf plant for complete nourishment. The biology of very few lepidopterans has been studies from high altitudes. A report on biology of *Yponomeuta rorellus* is reported from Ladakh (Dar *et al.*, 2017). The life history of *Pontia daplidice* has been studied in Himachal Pradesh (Sharma, 2005). The present study has found the association of *Cynthia cardui* on *Malva parviflora* in district Kargil of Ladakh region for the first time.

MATERIAL AND METHODS

The present study was carried out in the study area of district Kargil during the year 2015 - 2016. Kargil district spread over an area of 14,036 km² lying between 32° 15' to 36° latitude and 75°15' to 80°15' longitude. Kargil district comprises of South-western part of Ladakh located at an altitude of 27° 04' metre above sea level on the Suru river. It occupies its unique position because of its high altitude areas ranging from 2,704 metre to 7,135 metre above sea level in the country. Adult female chooses a plant that the caterpillars can consume, which grows from the eggs; it lays its eggs on the lower side of the leaves. The infested leaves were plucked and shifted to the laboratory to study the biology of the insect. Fresh leaves of *Malva parviflora* were used to feed the larval stages. The mode of damage was observed. Photography was made to show the different stages of the life cycle of *Cynthia cardui*.

Distribution

The painted lady is found throughout

Europe, Asia, Africa, North America, and Central America, almost on every continent except Antarctica. It is also found in Pakistan (Mohammad Attaullah *et al.*, 2018) In Jammu & Kashmir it has been reported from Jammu by Anu Bala, Kashmir by Qureshi. Earlier it was also reported from district Kargil of Ladakh region (Tara and Zakir, 2016).

RESULTS

In the present investigation, following aspects were observed while studying the biology of *Cynthia cardui* in Kargil, J&K (India). The temperature and relative humidity recorded were 23 ± 5.5 and 26 ± 5 .

Copulation

Cynthia cardui being a butterfly is diurnal and active during day.

Eggs

Eggs laid in groups of 5-13 on the underside of the leaves. Eggs were light green coloured. They are oval, larger than broader and have 10-15 longitudinal ribs. They turned whitish or colourless before turning to larval stage.

Incubation

The hatching of a small worm like larva known as caterpillar from egg represents first instar stage. Incubation period of 4-5 days was recorded.

Larval stages

The larvae of *Cynthia cardui* represent the damaging phase which greatly affects the host plant. Newly hatched larvae feeds voraciously from the centre as well as the edges of the leaf.

First instar

The body slightly covered with hairs. Head, cheeks, clypeus, frons and vertex are black coloured. The dorsal side is blackish to brownish black while as the ventral side is brown or light brown. Abdominal legs are four in pair which not fully developed and are non functional. Anal leg with a single pair.

Second instar

Body slightly increase in size. The head appears larger than the body with prominent thoracic legs. Anal legs or claspers increase in size, start functioning. The yellowish spots on the body start appearing. Hairs on the body increase in size and number. Consume more than first instar larvae.

Third instar

The body of third instar is covered with tiny

black and white hairs and it appeared completely black. Head black coloured supplemented with more hairs on it. The size of anal legs increased and becomes fully functional. Setae increase in number and size on dorsal side and appeared slightly yellowish. They ate more, live solitarily and were fast in movements. On disturbing, coil itself like a coil wire and behave like being dead. It takes about nearly 5-6 days.

Fourth instar

Head black coloured and concentrated with more hairs than other segments of body, but appeared smaller than the body. The whitish hairs along with blackish hairs increased in number on the body, however frons carry less whitish hairs. Feeding rate is higher during this stage. They also ate more and found singly and preferred to live in the middle areas of leaf encircled around the body. The larvae grow in tremendous amount and takes about 5-6 days.

Fifth instar

Head black in colour and appeared larger than the body parts or segments. Head carried more whitish hairs than other parts. Body turned thickest at mid abdominal segment covered by whitish hairs completely along with yellowish hairs. Mid-dorsal line becomes more prominent with yellow coloured strips between the white hair strips. They started feeding less and move slowly. During last days it stops consuming and moved to a suitable place for pupation. Its skin becomes too small for its growing body. The skin, or exoskeleton, splits and then sheds several times as it grows. During moulting the outer cover of the skin was observed and stored. This stage lasted for about 4 to 5 days.

Table no. I show the morphometric calculations of five larval stages observed during the study while as Table II shows the duration of different life stages.

Prepupa

After voracious feeding, mature fifth instar contracts its body, appendages and stops feeding. This marks the prepupal behaviour of the butterfly. During this period the larva hangs or sticks itself to a suitable place with its posterior end. It is a shorter phase and remains for about 1-2 days.

Pupa

The pupa is in a protective case. A butterfly pupa is called a chrysalis. Inside the

chrysalis, the pupa turns into an adult butterfly. Body, spiracles and Wing case are golden brown coloured. Lemonish spots visible on the wing. Pupa was observed as free and hanging. This stage lasted for about 7 to 12 days. After breaking of pupa, adult was formed. Pupal size is 15 to 18 mm.

DISCUSSION

The Kargil district of Ladakh region have a cold arid climate with prevailing cold desert conditions as it lies beyond the monsoon range and receive meagre rainfall. The arid atmosphere with

Table 1. Morphometric measurement of different life stages of *Cynthia cardui*

Stages	Length	Mean ± SD	Breadth	Mean ± SD	H.C width
Egg	2-3 mm	2.44 ± 0.35	1- 1.5 mm	1.22 ± 0.19	
Ist instar	4-5 mm	4.42 ± 0.38	0.5-1.0mm	0.72 ± 0.19	0.7-1.0 mm
2 nd instar	7-10 mm	8.6 ± 0.96	1-2 mm	1.54 ± 0.38	1-1.5 mm
3 rd instar	15-16 mm	15.52 ± 0.34	2-3 mm	2.48 ± 0.39	1.7 mm
4 th instar	25-27 mm	25.9 ± 0.83	3-4 mm	3.5 ± 0.38	2.5 mm
5 th instar	34-36 mm	36 ± 0.79	4-5.5 mm	4.72 ± 0.56	4.0 mm
Pupa	15-20 mm	17.2 ± 1.92			

*H.C: Head capsule

Table 2. Duration of different life stages of *Cynthia cardui*

Stages	Duration	Mean ± SD
Copulation	1.0 - 1.2	1.1 ± 0.1
Incubation	3.5 - 5.0	4.4 ± 0.61
Larval Period	15.0 - 20.0	17 ± 1.58
Prepupal Period	1.0 - 1.2	1.1 ± 0.1
Pupal Period	14.0 - 15.5	14.14 ± 0.59
Total Life Cycle	34.5 - 42.9	38.08 ± 3.36

extreme temperature, thin air, cold winds and low pressure and high ultraviolet radiations determine the scarcity of vegetation. (Vis *et al.*, 1987) In Jammu and Kashmir forest area constitutes about 14.5 percent of total geographical area while Ladakh has 0.06 percent area of the state is under forest plantation despite being the largest region of the state. The dry weather and severe winter are the major constraints in the development of agriculture. Besides, this meagre vegetation infected by the insect pests lead to the decreased vegetation and



Fig. 1. Different stages of *Cynthia cardui*

crop yield. So it is the need of the hour to protect such medicinal herbs having antioxidant activities and take a control measure for their survival. Keeping this in view, the present study was performed in the cold arid soils of Kargil (Ladakh) for the first time. However the *Cynthia cardui* has been studied as an insect pest of artichoke, lupin, clover, thistle, nettle and mallow also. (Hammad *et al.*, 1976) reported the incubation period as 30- 44 days, 46-67 days, 47-82 days, 47- 81 days, 30- 44 days respectively. Besides the work on the biology of *Cynthia cardui* has been also done in Egypt (Hammad and Raafat, 1966). Therefore a proper check-system and control measures is required to control the harm done by this pest. Avoid rotating of larval host plant in the endemic areas. Introduction of its parasites as *Chestogaedia monticola* and others in the field. Rising of water level in the fields to drown the larvae mainly during the larval and the pupal stages of the pest and increased use of fertilizer that lead to enlarged growth of the herb and its parts. These measures may control the harm to some extent, however further studies is essential to control their infestation and protect such medicinal herbs.

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