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Notes on Biology and Life Cycle of Giant Redeye (Gangara Thyrsis) Butterfly

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Abstract:- Giant Redeye butterfly is the largest skipper which is a minor pest on the ornamental plants of certain palm species. Study of biology and life cycle of Giant redeye (Gangara thyrsis) has been done in natural and artificial conditions. The areca palm (Dypsis lutescens) is the most common host plant. The caterpillars of the Giant redeye feed on the youngest leaves of the areca palm. In natural condition, the population status, the host plant availability and life cycle generations and habitat preferences were studied in the vicinity of CHRIST (Deemed to be University) main campus at Bengaluru in India and is described and illustrated through photographs. The leaf consumption by caterpillars and subsequent changes in the morphology was observed. The behaviour and morphological characters of the eggs, caterpillars, pupae and adult emergence were observed. The consumption potential of different stages of caterpillars was also monitored. On average the total duration till the adult stage lasts for 30-35 days. The waxy material, construction of the cell and the drumming sound are unique to some of the skippers including Giant redeye. Though it is available throughout the year, it was observed that number has declined with the beginning of dry season of the year. In the present study certain conditions of stress were also provided in order to study its adaptations. When subjected to starvation it has reduced its body size to half and partially entered the pupa stage but couldn't complete its life cycle. Majority of the eggs from the plants and various other stages are lost to a variety of parasitoid wasps, insects and some birds. This organism overcome all these challenges and sustain in the environment.

Keywords:- *Consumption Potential, Dypsis Lutescens, Gangara Thyrsis, Life Cycle, Parasitoid Wasps*

I. INTRODUCTION

The Giant redeye butterfly is the largest skipper of peninsular India. It belongs to the order Lepidoptera and the family Hesperidae which are known for their quick darting flight habits. It is a common butterfly available throughout the year but not spotted often due to its crepuscular and nocturnal habits. Estimating by the copiousness of its caterpillars, the Giant red-eye is the most common skipper and its abundance depends on the host plant availability in the locality (Kunte, 2000). The butterfly visits the host plant throughout the year most common from the post-monsoon to pre-monsoon months.; uncommon during the dry season of the year (figure 01).

The biological studies of Hesperidae butterflies have been done by various authors across the globe. It was first reported during 1956-57. Wynter – Blyth (1957) stated that this large skipper is crepuscular- resting during the day but being active shortly after dawn and again at dusk (Steiner, 1997); Watson (1991) reported the wing expansion to be around 2.5 to 3.25 inches; Sathiamma and Abraham (1998) reported that the larva of Gangara thyrsis consumes about 162 sq.cm of leaf during its larval stage; Narayanan and Veena kumari (2002) stated that damage of this pest is usually confined to seedlings and young palms of around 5 years old; Krushnamegh kunte (2006) in the book "Butterflies of Peninsular India", gave detailed information on Giant red eye butterfly, Kalesh and Prakash (2007) reported the larval host plants. But very limited published works are available all over the world on this butterfly. It is very essential to acquire knowledge on the biology and feeding behaviour of the butterflies for understanding its host plant relationship and duration of each instar for its conservation management and host plant protection.

The formerly reported host plants of Giant redeye are Dypsis lutescens, Cocos nucifera, Calamus pseudoformes, Calamus rotang, Calamus thwaitesii, Caryota urens, Chamaerops humilis, Corypha umbraculifera, Phoenix acaulis, Phoenix loureirii, Licula grandis, Licula chinensis, Cyperus alternifolius, Phoenix humilis. Early stages were known to feed on the Banana and Bertam palm (Eugeissona tristis). Saccharum officinarum has also been recorded but was found to be doubtful and needed conformation. Zingiber officinale has also been reported but the larva feeding on it did not known to pupate so this was left suspected (Nitin R, 2018). Due to extensive cultivation of coconut or ornamental palms, it is common in South India especially in Karnataka (BASAVARAJAPPA, 2015) and most abundant in Western Ghats (KUMAR GHORPADÉ, 2010) , Kerala (K.S. Aneesh, 26 May 2013), Tamilnadu (J Alfred Daniel, 2018) and also seen in the Eastern Ghats of Odisha (Palita, June 2018), Mulshi in Maharasthra (Ranade, 1996) and North East part of India (Prarthana Mudai, 2015). It occurs in evergreen and semi evergreen forests. It is also distributed in Sri Lanka (George Michael van der Poorten, June 2016), Bangladesh (A T M F Islam, 2011), Andaman and Nicobar Islands (C. Sivaperuman, October 2016). It is similar to the Palm Redeye Erionata torus and Common Banded Redeye Matapa aria. (Kunte, 2000)

The most remarkable character of Giant redeye is its large wine red eyes. It is a dark chocolate brown coloured butterfly with three large and three small apical, yellow

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spots on the forewings. The bottom of the hind wings is heavily sprinkled with grey scales, which form obscure bands. Both male and female look alike. Giant redeye butterfly has the longest proboscis compared to the body among the peninsular Indian butterflies and it is uniquely curved. It runs free from the tips of the wing-cases, takes a complete turnaround itself and ends near the abdominal tip. Extraordinarily long proboscis –long absolutely in comparison with its body length helps to obtain nectar from the longest flowers. The most distinguishing characters of the pupa are proboscis and cremaster. Body band is absent but the role of attachment is performed by the Cremaster. It is a thick, triangular, down-curved pad of silk armed with processes on the sides. The larva is pale greenish with red-orange markings and its physical structure is concealed in a crossing of white waxy structures (Saji, 2018). The caterpillar is cylindrical and rounded at the end. Thoracic segments, neck and brain are much smaller in comparison with the physical structure. Head is broader and rounded at the base, but narrow at the tip. It is dark chocolate brown in colour, though it looks white due to a thick coating of powder that covers its entire body (Kunte, 2000).

Giant redeye is crepuscular in its habits and flies only after dusk or during the early night. It doesn't bask in the sunlight, once in a while it is attracted towards light. This butterfly rests on vertical planes in dark places at any height from the ground; at dusk it starts its activity. It can fly at any height from the ground or long distances to forage. Flight is exceedingly quick, winding and often long held. Long proboscis consequently helps to draw nectar from longest flowers available in the woods. It is fond of feeding from flowers as it is the only source of nutrition. It is constantly alert and gets off at the slightest intrusion. The female lays one egg at a time on the upper surface of the palm leaflet. The caterpillar secretes a waxy substance which forms soft pillars on the body and completely hides its surface. From the body loose shaggy filamentous clothing consisting of pure waxy substance is excreted, but it is rubbed off when handled leaving it naked and looks pale green, the real colour is seen when this powder is taken away. During pupation the caterpillar is believed to enter into a shell formed by weaving the leaves to shape a small cylindrical funnel. After 3-4 days of hatching the caterpillar folds a triangular portion from the edge of the leaflet, usually close to the tip and makes a tubular cell for itself. When it is older and needs more food to eat, it makes a cell somewhere in the middle of the leaflet eating only that portion which is in front of the cell up to the tip. The interior of the cell is densely lined with silk. The discarded half eaten leaflets and cells are visibly lined with silk. The caterpillar rests in the cell with its head and thorax up to the 4th segment turned to the position and its body oriented towards the exposed end of the cuticle. The growth of different stages of caterpillar is slow and consumes large number leaflets to complete its growth. When the pupa is disturbed the uniquely curved large proboscis of it is rubbed against the ridge which produces a hissing/drumming sound and shakes the cell. This is the strategy used when pupa is disturbed. The mean total duration of life cycle is 30-35 days till the adult stage. About 60-70% of the eggs fall prey to parasitoid wasps (Kunte, 2000). The parasitoid wasps lay their eggs within the Giant Red eye eggs and feed along the egg contents and pupate there. After completing the metamorphosis, the adult wasps emerge from the butterfly eggs by puncturing holes on the top. Though this Giant redeye is considered as a pest on areca palm, the damage caused by it is less compared to the other pest species. The availability of larval and adult host-plant is the most important factor for the presence of butterflies in any study area, so the host plant availability and its identification was done on the basis of available published data and as well as field observations. The main objective of the study is to understand the metamorphosis and the behaviour of different stages of the Giant Redeye butterfly in natural conditions. Studies were done in artificial conditions also, to monitor the changes adapted by different stages of the organism in order to endure in the environment.

II. MATERIALS AND METHODS

Eggs, caterpillars and pupae were field collected as specimens for the study and were reared individually. The present study was conducted in the CHRIST (Deemed to be University) main campus, Bengaluru, India. It is located in the southern part of Bengaluru Urban. The main campus of this university (12.560 N, 77.360 E) is spread over an area of 40.61 acres within the heart of Bengaluru in the Deccan plateau of Southern India. The built up area of the city campus is 226671.5 Sq. m. To study the biology and life cycle of Giant redeye, eggs were first identified from its host plant habitats. In the study the eggs and immature stages of Gangara thyrsis were collected from areca palm, Dypsis lutescens to gather the biological information. The hatching time and the caterpillar movements were monitored. Instar wise larval duration was recorded using MOTO g 5s plus camera (13+ 13 MP dual back camera (f/2.0 dual LED flash SLR camera). Behavioural and morphological observations of different stages of the present butterfly was carried out in the field as well as in the laboratory. The rearing has been done in transparent plastic boxes, tightly sealed with rubber bands from which excess moisture and excreta were cleaned daily. The food plant leaves were replaced on every second day as delay causes death of the larvae when fed on even slightly decaying leaves. The plastic containers were examined daily to observe instar changes and behaviour. Observations on the biology of Gangara thyrsis were conducted under laboratory conditions under natural light. Daily observations were made to determine the duration of the stages of development until the emergence of the adult. Though there might be appreciable differences under natural compared to artificial conditions, records suggest that the duration of the life stages reported here may not correspond exactly with natural life cycle durations and to the growth of the organism. The study was performed based on the information available in the Butterflies of Peninsular India by K. Kunte (2006).

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III. RESULTS

- Observations on development and relative food consumption:

The female lays one egg at a time on the upper surface of the palm leaf. Eggs and various stages of caterpillars, pre-pupa and pupa were observed all over the year but number decreased in the beginning of the dry season of the year (Table 02). Eggs were mainly observed in the sunlit areas on the top slender leaves on the plant. Before hatching, the eggs become transparent with an appearance of black spot in the centre of the eggs. It took five minutes' time to emerge as a first instar larva from this position. After hatching, the newly emerged larva consumed the eggshell and moved over the lower side of the leaf and then started feeding on the tender leaves. In natural conditions after hatching it occupies the underside of the leaf and makes small folding of the leaf as a protection from the predators. It positions itself on one end of the leaf in the centre and produces thin silk like layers. These layers join both the sides of the leaf and turn over to a roll like appearance giving the caterpillar protection. It was also observed that the first instars larvae do not change their original leaves where they were hatched while other instars move from one leaf to the other after consuming the leaves, but the first one after hatching remains on the same leaf and occupied the same place and ultimately make a spherical or oval hole on the leaves. After 2-3 days the first instar larva moulted to second instars larva by casting off its old skin.

With the increase in the length of the body, the larva starts moving to new leaves and makes new tunnel like structures for feeding. It places itself on the centre of the leaf and show pendular movements and joins the two sides of the leaf. It stays in the tunnel/cell with its head towards the opening eating only that portion of the leaf which is in front of the cell up to the tip. The second instar larva grown up and ready for moulting to the third instar larva was about 2-3 days. In artificial conditions due to less leaf consumption, it doesn't show much movements and cell/tunnel made was different from the natural ones. Less production of the waxy material and the body is partially covered with silk. Due to its lethargic behaviour and poor consumption, moulting was delayed for 1-2 days and later it entered the next instar. The overall length of the larva gradually increases. The feeding intensity was found to increase and started to consume more leaves. Huge amount of frass was observed in the area of the plant because of efficient feeding. From this stage, the larvae start to eat fresh and mature leaves of host plant. The total duration of third instars larvae lasted for 3-4 days. It grows very slowly and needs many leaflets to finish its growth. During this stage, it makes a bigger cell like structure by joining the adjacent leaves and stitch a large cell that can accommodate the increased body. Whereas in artificial conditions, the production of waxy material was very less, exposing its pale brown coloured body. Due to continuous drying of the leaves, shifting of the caterpillars from the dried leaves and to a fresh one was done. That didn't improve the consumption level instead one-two caterpillars were found to be very weak for further development. The freshly emerged fourth instar larvae turned into a thick white structure. It looks like a white crawling thread. The caterpillar secretes this powder which forms soft pillars on the body and completely hides its surface. The inner side of the cell is covered with the waxy material. The actual colour of the caterpillar seen when this powder is removed is light green. From fourth instar larval stages, the rate of growth increases and the larvae changed its resting position from time to time on the lower surface to the mature leaves of host plant. The mean total duration was measured 3-4 days. It is highly active during this stage and moves along the lower side of the leaf. But some of the caterpillars grown artificially in present study doesn't reach this stage due to poor consumption, reduced growth rate and regular shifting of them onto the new leaves. During this stage the feeding/consumption potential was found to be very high in contrast to previous stage and they prefer mostly young and matured leaves (figure 03). This stage lasts for about 1-2 days and before pupation it stops feeding. It makes a cell with the leaves for itself. The feeding behaviour was observed throughout its larval stages. The caterpillar never walks away; it pupates on the same plant.

- After 2-3 days the mature larvae is converted in to chrysalis.

In the present study, it was observed that the caterpillar was able to survive and weave the cell even after the removal of the waxy material from its body. It produces the same quantity of the waxy material in a short time to seal the cell/tunnel. At maturation, the larva stops feeding and vigorously moves in search of pupation site. After finding a pupation site the caterpillar folds a triangular portion from the edge of the leaflet usually close to the tip and makes a tubular cell for itself. The caterpillar places itself in the cell with the head, thorax up to 4th segment and its body oriented towards the widely open end of the cell. Through the other open end, cremaster and the abdominal segments of the pupa can be seen. It is quite sluggish and unwilling to move if the cell is opened. Gradually, the colour of the matured larvae became pale and the larvae started to moult and completed the process in 45-60 minutes. When the pupa is disturbed, the proboscis is rubbed against the ridges of the leaf, which produces a hissing sound. Because of its spacious cell and the absence of the body-band, the pupa can violently vibrate within the cell. These vibrations are produced for a long time till the pupa feels it is away from the predator. The entire body shakes hitting the long proboscis to the walls of the tunnel. In this process of banging itself hard on the walls of the cell makes a drumming or hissing sound. This is the strategy used when pupa is disturbed. After 20-22 days the butterfly emerges usually during the early hours of the night. After emergence, the fresh adult butterfly wings were very soft, smooth and wet and gradually dried up. Both males and females with same colour pattern and wing shape. The wings first open completely and as they become dry a fold develops at the inner margin of the hind wing. The wing beats are audible during the silent hours when observed from a short distance. It flies at a greater height as well as close to the

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ground. The adult after the emergence took 10-15 hours to open its wings completely and take its first flight. Though it is seen throughout the year its population distribution depends on the host plant availability (Figure 04).

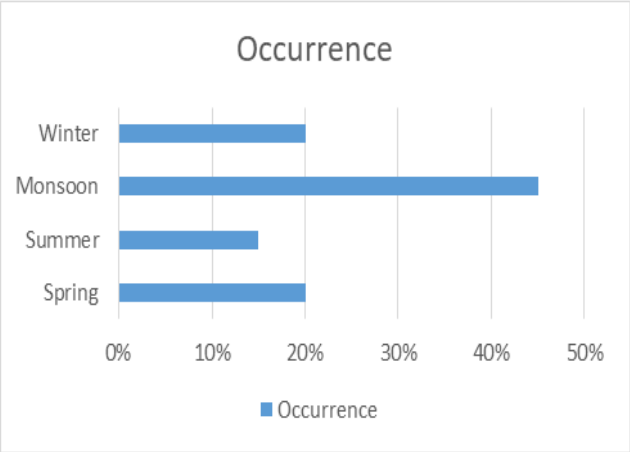

Fig 1:- Representation of the availability of the Giant redeye season wise

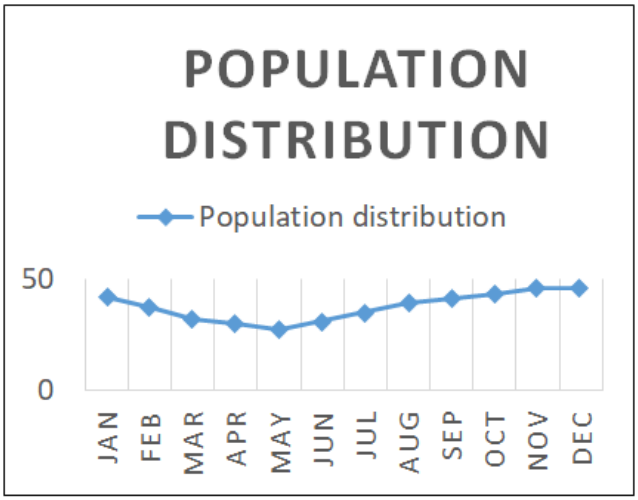

Fig 2:- Depiction of the population distribution of the Giant Redeye throughout the year

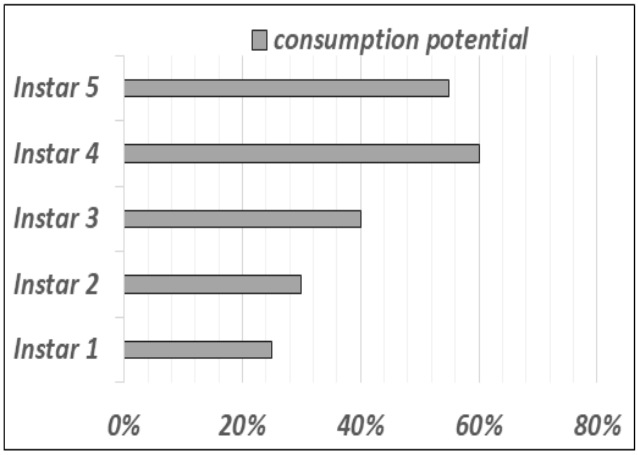

Fig 3:- Consumption potential of Giant redeye caterpillar instar wise

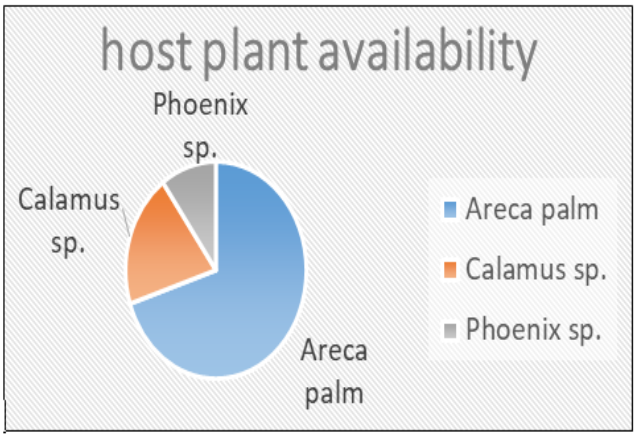

Fig 4:- Graph depicting the host plant availability of the study area

IV. DISCUSSION

Butterflies are an important model group for the study of natural history than any other groups of insects (Ackery, 1984). The study of natural history of butterflies is very essential to know the host plant relationship, habitat preference and life history information. According to Ackery,1984, the study of the biology of butterfly is necessary for fulfilment of the part of systematics and faunistic studies. The previous studies have shown that the Giant redeye does not travel long distance from their habitat if adult and larval host plants are available. The Giant redeye lays solitary egg on the lower surface of the tender leaves of their host-plant. This butterfly selects a narrow tender leaves and lays the eggs near the midrib of the tender leaves. The eggs are hatched after an average of 5-6 days and immediately after hatching young 1st instar larvae consume the egg shell and take rest for few minutes then move for feeding. The consumption potential tends to be increase progressively and highest consumption takes place during fifth instar larval period. During 5th instar or mature larval stages, the Giant redeye consumed about 63% of total food compared to both instars. During the conditions of stress by exposing it to direct sunlight, it couldn't withstand the heat and continuously flattered the wings. The second condition provided to the fifth instar was starvation. In the absence of food, it reduced its body size to half and the production of waxy material has been reduced. This shows that the more the leaf consumption the more is the waxy material produced.

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