© 2018 IJSRST | Volume 5 | Issue 2 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section:Science and Technology

Biosystematic study of Glyptapanteles malshri sp. Nov (Hymenoptera: Braconidae)

***Inamdar S. A.**
Department of Zoology, Modern College of Arts, Science and Commerce, Pune, Maharashtra, India

ABSTRACT

The order Hymenoptera is extremely important from the view of Biological control of insect pests. Biology forms the basic information for the workers involved in biological control programmes for formulating mass rearing. The genus glyptapanteles is rcognised bu Ashmead in 1905. It is one of the larger segregates of the old "Apanteles". 5-10% of the species in temperate regions and about 25% in tropic , probably 1000 species in Wilkinsons group A or Nixons species group. 198 females and 111 males, wings, antenna, legs were mounted and studied. 150 early second instars of Plutella xylostella (Binn) on cabbage were exposed to five mated females of Glyptapanteles malshri sp. Nov. Parasitoid eggs and larvae were collected after 12h interval by dissecting parasitized host larvae in saline.

Keywords : Hymenoptera, Biological control, Glyptapanteles

I. INTRODUCTION

The parasitic hymenoptera is an important component in biological control programme. Biological control and taxonomy are interrelated and interdependent. Taxonomists need for the identification of biological control agents, understanding their evolutionary history, compilation and to guide explorations for native and exotic parasitoids. The detailed taxonomical works on Indian species were those of Wilkinson (1928, 1929), Bhatnagar (1948), Rao (1961), Nixon (1967), Rao and Chalikwar (1970), and Sathe and Inamdar (1988, 1989). In assessments of parasitic hymenoptera a reliable approach would be to study their lifecycle stages. Biometrical data is helpful in separation of different instars of the species. Fulton (1940), Cardona and Oatman (1971), Rojas – Rouse and Benoit (1977), and Sathe and Nikam (1985) have attempted such type of studies. It is estimated that there are about 250,000 species of parasitic Hymenoptera in the world, of which only about 50,000 have been described (Gupta 1988).

The family Braconidae having almost 40,000 species is divided into 21 subfamilies, some important among them are Euphorinae, Microgastrinae, Braconiae, etc. The subfamily Microgastrinae is of economic importance because they breed from the lepidopterous hosts. It includes the three genera into which Foerster Microgaster Lateriella, Microgaster, Microplitisand Apanteles. Apanteles genus was given by Foerster in 1862. Nixon (1965) divided this genus into 44 species groups. Some of these groups are very large like ater, ultor, etc: some groups, on other hand, have less than half a dozen species. Rao (1961) compared critically this genus with the help of all available literature and type specimens and divided Apanteles into two subgenera viz. Areolatus and Carinatusby presence or absence of propodeal areola as the main, valid and important character for the division. The catalogue of Apanteles Shenefelt (1972) lists 1118 valid species and nearly 200 more have been described since then for a total of about 1300 species. 2000 species have been included under this genus by Mason (1981) from different parts of the world. Organized

The genus Glyptapanteles is recognized bu Ashmead in 1905. It is one of the larger segregates of the old "Apanteles". 5-10% of the species in temperate regions and about 25% in tropic , probably 1000 species in Wilkinson's group A or Nixon species group virtripennis, octonarius, pallipes, siderion ,demerter, fraternus, triangulator are included under Glyptapanteles. The vitripennis being especially well developed in cool and humid temperate climate while the octonarius in humid warm temperate and tropical climate. The genus Glypatapanteles is less well represented from dry climate.

Mason kept the following neartic species to Glyptapanteles(new combination) : (octonarius group). Apanteles affray Muesebeck A.cassianus Riley A.floridanum Mues., A.herbertii Ashmead.

Glyptapanteles malshri sp. Nov.:

Length 4.08 mm excluding ovipositor , forewing 4.00mm long , antenna 3.56 mm long , weakly trapered to apex.

Head:

0.80 mm long, it is circular and convex smooth ; interorbital space is 0.80mm which Is width of head , ocelli in triangle , ocellar space equal to the interocellar Space , front ocellar is 0.16mm frons smooth dark brown , shiny . Antenna 16 segmented 3.56mm, smaller than length of the body , first 7 segments having transverse band , first segment smaller than other 15 segments penultimate segment 0.25mm .

Flagellar formula:

2 L/W = 2.5 ; 14 L/W =2.4 ; L 2/14= 1.1 , W 2/14 = 1.0 Eye pubescent, 0.37mm long , 0.1mm wide ; molar space rugose.

Thorax:

1.68mm long ; mesonotum lacking setae on the sublateral lobes, punctuate ; width of tegulae is slightly broader , brown , 0.12mm long . Propodeum 0.48mm broad and 0.40mm long , smooth, only middle region is coarsely punctuate , no trace of areola, prepctal carina absent. Fore wing length 4.00mm ; stigma is dark black in colour and hairy ; radius and intercubitus slightly equal ; radius is strong ; basal vein strongly angulated Hind wing 3.5mm long , vennal lobe convex with fringe of hair , areolet open . Hind leg 4.67mm long , yellow in colour ; hind tibia with strong spines on outer side ; length of femur is 1.04mm tibia is dark brown colour , 1.08 mm long , spurs equal , 0.24 mm long , sharply pointed ; 0.60mm length of hind basitarus ; tarsal segment are 1.08mm long claws 0.12mm long , curved inside , black in colour , pointed .

Abdomen:

Spindle shaped , 1.60mm long ; tergite I never wider at apex , 0.28 mm long , the sides gradually converging apically and strongly rounded to apex ; tergite II 0.23mm long tergite III ; basal two tergites completely smooth and polished , ovipositor 0.28mm long and ovipositor , few hairs concentrated near the apex .

Male:

Similar to female , length 4.0mm .

Cocoon:

White , 3.4mm long .

Host:

Plutella xylostella (Binn) , on cabbage .

Holotype:

Female , India , Maharashtra , Kolhapur , on cabbage , Brassica apitata L , collection , January to June 1988 - 1989 ; antenna legs , wings , on slides , labelled as above .

Paratype:

23 females, 52 males , sex -ratio , Male : Female , 1 : 0.44 . Same data as in holotype , reared from larvae of the above mentioned host in India , Maharashtra , Kolhapur , collection in January to June 1988 - 1989 .

Discussion:

Glytapanteles malshri species run close to Glyptanteles militaris (weed) in Mason's key in its characters.

1. Ovipositor sheath is shorter than ovipositor and with few hairs concentrated near the apex.

2. Areolet open (2 r-m absent) .
3. Tergites I always tapering apically, tergite II sub triangular and wider posteriorly.
4. In propodeum, areola absent but trace of longitudinal median carina present .

It differs with
1. Propodeum is with two lateral carinae.
2. Antenna smaller than its body .
3. The first 7 segments having transverse band .
4. Vannal lobe of hind wing convex and fringed with hairs .
5. Hind leg 4.67mm long , faint brownish - yellow in colour .
6. Tergite Irugose and punctuate.

Glyptapanteles malshri sp. Nov. (Fig I):

Egg (Fig I-2):

At the time of oviposition the egg of G.malshri is translucent, white , smooth surface and is cylindrical , slightly acute . Usually only one egg is deposited per host. The ends of the egg are somewhat rounded and there is no visible stalk or pedicel. The chorion is transparent and lacks surface sculpturing but somewhat smaller than the newly laid eggs .Eggs is randomly deposited in the hemocoele of the larvae. At deposition, the eggs contents are homogeneous. However, as development proceeds, the embryo was distinctly visible with nine narrow segments in the middle portion of the body . Free embryonic cells have been found in the host blood, it appears that may constitute part of the food of the parasitoid. The ripe ovarian 25 eggs averaged 0.52 mm in length (range 0.49- 0.54) and 0.187 mm in width (range 0.175 - 0.196 mm). Egg hatching period is 1-2 days.

Larvae:

G.malshri has 3 larval instars.

First instar (Fig I-3):

It is noted that the first instar found floating freely in the body cavity of the host, usually at about 5th or 6th abdominal segments. The head of the parasitoid larva directed towards the head of its host. Eclosion is protracted process which may require up to four hours. The larva forces its head through the egg, splits from anterior side. The body consists of a broad quadrate Head, 3 thoracic and 7 abdominal segments. There are two raised oral papillae situated anterior to the mouth which are capable of contraction and retraction. This instar is manipulate type . The mandibles are long and sharply pointed when at the rest their edges cross each other. These are not densely sclerotised at this stage and are capable of free and quick movement. The tracheal system was not seen in this stage. The mean body length and width of 25 individuals averaged 1.31 mm (range 1.28 - 1.38 mm) and 0.24 mm (range 0.21- 0.26 mm) respectively . The mean length and width of head capsule in 25 individuals were 0.101 mm (range 0.098 - 0.11 mm) 0.085 mm (range 0.079 - 0.095 mm respectively. The averaged length of 25 mandibles was 0.05 mm (range 0.032 - 0.061mm) and width was 0.015 mm (range 0.012 - 0.017 mm) while vesicle averaged in its length and width 0.22 mm (range 0.21 - 0.24 mm) and 0.24 mm (0.19 - 0.29 mm) respectively. Mature first instar is almost pale yellowish in colour. The head become less prominent and narrower than the rest of the body. The vesicles is minute in young host instar, but it appers to be well developed, bladder like by 2nd day after eclosion. The first instar lasts for 3 days.

Second instar(Fig I-4):

Second instar was first found on the 5th day after oviposition. It was hymenopteri form and somewhat oval in shape. The opaque body is creamy white and consists of a narrow head, 13 well defined segments and a prominent vesicle. The cuticle is smooth and appears to lack setae. The cephalic structure is very weakly sclerotized, so that the mandibles are easily discernible even in cleared specimens. The head is smaller and more sclerotized. Evagination of the last segment has prominently developed into a vesicle with clearly seems to consist of a single layer intestine. The paired salivary glands were very conspicuous forming series of loops. The tracheal system is well developed with two longitudinal trunks. Into the head , some

short branches are extended and posteriorly then run almost the entire length of the larva. These longitudinal trunks are connected just behind the head by a dorsal commissural. Still no spiracles have seen. Spines or setae were not apparent on the body. The mean body length and width of 25 individuals were averaged 1.72 mm (range 1.53 - 1.91 mm) and 0.378 mm (range 0.355 - 0.389 mm) respectively. In 25 individuals, head capsule measured 0.189 mm in length (range 0.172 - 0.183 mm). The averaged length and width of 25 mandibles were 0.63mm (range 0.048 - 0.79 mm) and 0.23 mm (range 0.016 - 0.027 mm) respectively . Measurement of vesicles in 25 individuals averaged 0.53 mm in length (range 0.15 - 0.58 mm) and 0.64 mm in width (range 0.61 - 0.67 mm) . The second instar lasts for only one day.

Third instar(Fig I-5):

The third instar appeared 7th day after oviposition. The body of larva is creamy white and opaque , consists of the head and 13 well defined segments . It tapers slightly toward both the ends. Early last instar have an anal vesicle, the structure gradually decrease in size and lastly disappears in matured larvae.

The cephalic structure is well developed and is described according to the terminology of short (1952 - 1953). The head is well developed with two prominent mandibles and sclerotized facial structure. The head is divided into a dorsal epicranial part and ventral buccal region. The epicranial part consists of a frons with two lateral rudimentary antennal stockets and a clypeus. The buccal area consists of a supra oral labrum the mouth and two dark brown sclerotized mandibles with saw like teeth on the dorsally directed cutting edge. Each mandible is with a broad proximal base tapering distally to a sharp point. The broad base articulates dorsally with the anterior pleurostomal process and ventrally with the posterior pleurostomal process. A strongly curved hypostoma with a ventrally directed sclerotized hypostomal spur lies behind each maxilla. The labial sclerite is supported by lateral stipital sclerites on each side. The labium has two oval labial palpi a silk rest of the body and is apparently telescopic.

Digestive system is well developed; which consists of the mouth, a slender oesophagaus, a large mid intestine closed at its posterior end and the anus. The silk glands found surrounding the digestive tract. In 3rd instar larva 8 pairs Of spiracles are very prominent. One pair is situated in 2nd thoracic segment and one pair in each of the 7 abdominal segments. While rest of the tracheal system is similar to 2nd instar. The average diameter of thoracic spiracular opening was 0.009 mm. The average body length and width Of 25 third instar were 2.75mm (range 2.52 -2.85mm) and 0.679 mm (range0.45 -0.832 mm) respectively . The measurement of head capsule in 25 individuals averaged 0.32mm in length (range0.31 - 0.34mm) and 0.301mm in width (range0.292 - 0.304mm) . The average length and width of mandible in 25 cases were 0.102mm (ranges 0.090mm - 0.104mm) and 0.040 mm (range 0.038 - 0.042 mm) respectively. The average length and width of vesicles were 0.25mm (ranges 0.20 - 0.31mm) and 0.30mm (range 0.26 0.33 mm) respectively, vesicles were smaller than second instar. The third instar lasted 1 -2 days. The parasitoid larvae were found floating in the posterior half of host larva. The mature parasitoid larvae exist from the host larvae, with the help of their mandibles by cutting the lateral line and thus killing their host .

Biometry:

Biometry studies of different instars of G.malshri showed that there is an increase in the length and width of larval form as well as in head capsule, mandible with respect to age (Table-1). The result obtained clearly indicated that there exists (length -$P < 0.50$, width -$P < 0.30$) correlationship between the age of the larval instar and the size which was tested with regression analysis ($r = 1.0$) for length and ($r = 0.974$) for width . The statistical result is tabulated in the (Table-2).

Cocoon (Fig I-6):

After emergence, the last instar larva of parasitoid form a silvery white, densely spun, cylindrical cocoon

which is round at both ends. The cocoon formed is attached with host food plant parts. The mean length and width of 25 cocoon were 3.4 mm (range 3.35 - 3.50mm) and 1.3 mm (range 1.21 - 1.35 mm) respectively.

Prepupa :

The prepupa appeared on the 9th day after oviposition and last for one day . It is differentiated from late 3rd instar by the appearance of the constriction in the middle portion of the body and by the pupal structures, such as segmentation of the abdomen , can be seen through the integuement. The length of 20 individuals were 3.2 mm (ranges 3.1 -3.4mm) and width 0.92 mm (range 3.1 - 3.4 mm) and width 0.92 mm (range 0.88 - 0.95mm).

Pupa(Fig I-7):

The pupa of G.malshri is of the exarate or free type , it is creamy white . The eyes were blackish and ocelli brown. As development proceeds, the entire pupa gradually darkens. The pupal appendages found loosely oppressed to the body. With the help of developing ovipositor the female pupa can be readily distinguished. The average length and width of 25 individuals were 2.90 mm (range 2.88 - 3.00 mm) and 1.05 mm (range 1.00 - 1.08mm) respectively. Under laboratory conditions 26 +- 1° c , the pupal period lasts for 6 - 7 days .

The average duration of the life cycle of G.malshri from egg to adult emergence was 15 - 16 days.

Emergence:

Emergence of the adult G.malshri as found at day time. The adult emerged from cocoon by cutting off at side a circular cap, which was pushed aside and usually remain attached. After emergence the adult spent a brief time for cleaning their bodies. If food available, feeding could occur immediately. Usually make emerged before female.

Adult(Fig I-1,8):

The male differentiated from the female by its sexual characters and dark abdomen. Antenna was 16 segmented and 4.08 mm long , shorter than body , propodeum contain longitudinal median carina and also both of lateral carina , vannal lobe of hind wing convex and fringe of hair , legs are faint yellow colour , Tergite rugoes and punctuate at apex . Length of female was 4.5mm, ovipositor 0.28mm long.

Mating:

Mating amongst the adult parasitoid was observed within 12 hr after emergence and it lasted for about 1 minute. Both sexes attracted towards each other when caged in plastic container (size 4 x 4 cm). The male recognized the female. After several attempts the male catch-up the female. By catching, the male suddenly mounted the female, and if there was no resistance, copulation took place. During mating, both sexes were remained, stationary. The males found perusing other females after separation and copulated with several. However the female apparently mate only once.

Preoviposition:

Immediately after emergence, both sexes were placed in small glass tube. The adults were supplied honey as food. At the time of emergency females already have a number of mature ovarian eggs but not deposited as soon as host material was encountered. It takes 20 hr before oviposition the preened and newly emerged

Females do not respond the host larva. The substrate is examined with the antennae by extending forward.

Oviposition:

After landing on the cabbage boll the female found searching for its host by moving around and tapping the cabbage surface with her antennae. If damage part come across , she become excited and start searching vigorously , and later , stabbing intention movements are made . The female examine continuously untill she located the probable position of the host larva on

the cabbage. She then quickly inserted the ovipositor in the host larva, the parasitoid deposited an egg in tge larva , requiring less than 2 - 3 sec . If the host was not contacted, the female withdrew her ovipositor and inserted it in a new place . The probing operation was persistently repeated until the host larva was parasited.

Host age selection(Table -3,4):

In this experiment optimum age for maximum was find out, Result are recorded in Table 12 & 13. The number of parasitoid emerged from host of age 2,3,4,5,6,7,8,9 and 10 days old larvae were 8,28,44,72,60,46,28,18 and 7 respectively , while parasitoids have not emerged from the hosts which were one day old . Maximum 48% parasitism was recorded on 5 days old hos000t0s a00nd meam number of parasitoids emerged per replicate under this age was 72 . Host larvae , older than 5 days that have been progressively less suitable . The regression analysis indicated that there was a significant correlation between host age parasitism (r=0.067, P<0.10)

Longevity:

Neither sex survived for more than two days without food and water. The result is shown in table 14. The mean survival of males fed with 10% and 20% honey was 5.3 and 7.0 days and in females 5.52 and 7.5 days respectively. Maximum survival of females was 13 days while make survived for 12 days when fed with 50% honey. In general, females live longer than males.

II. REFERENCES

[1]. Berisfordet. al, 1970. Notes on the biologies of Hymenopterous parasites of IPS spp. bark beetles in Virginia, *Can. Ent.,* 102, 484-490.

[2]. Bhatnagar1948.Studies on *Apanteles*Foerster (Vipionidae; Parasitic hymenoptera) from India, *Indian J. Ent.* , 10, 133-203.

[3]. Cardona and Oatman 1971. Biology of *Apantelesdingus* (Hymenoptera: Braconidae), a primary parasite of the tomato pinworm. *Ann. Ent. Soc. Am,* 5, 996-1007.

[4]. Clausen, 1940. *tomophagous* Insects New York: McGraw Hill PP, 688.

[5]. Fulton 1940. The hornworm parasite, *Apanteles congregates* (Say) and the hyperparasite*Hypopteromalustabacum* (Fitch), *Ann. Ent. Soc. Am*, 33, 231-244

[6]. Gupta 1988. Advances in parasitic Hymenoptera research. Clausen, 1940. *tomophagous* Insects New York: McGraw Hill PP, 688 Proceedings of the II conference on the taxonomy and biology of parasitic hymenoptera held at University of Florid, Gainesville, Florida Nov. 19-21.

[7]. Loan, 1963. Parasitism of the dogwood flea beetle, *Alticacorni* in Ontaria, *J.Econ.Ent*, 56, 537-538.

[8]. Mason 1981. The polyphyletic nature of *ApantelesFoerster* (Hymenoptera: Braconidae), a phylogeny and reclassification of Microgastrinae. PP, 1-147.

[9]. Nixon 1967. The Indo- Australian species of the Ultor group of *ApantelesFoerster* (Hymenoptera:Braconidae). *Bull.Br.Mus.Nat.Hist.(ent),*21, 1-34

Table no. 1: Biometrical Measurement of Larval instars *G. Malshri*

Sr.No.	Body structure	Larval instars		
		First	Second	Third
I	Larval Body			
	Length	1.31	1.725	2.75
	Width	0.24	0.378	0.678
II	Head			
	Length	0.1.1	0.189	0.323
	Width	0.085	0.180	0.301
III	Mandibles			
	Length	0.05	0.063	0.323
	Width	0.015	0.023	0.040
IV	Vesicle			
	Length	0.22	0.53	0.25
	Width	0.24	0.64	0.30

Table no. 2: **Statistical Linear Regression relationship between larval age and Length of body of** *G. malashri*

Instars No.	Age in days	X2	Larval leg.	Y2	xy	Expected value y
1	2	4	1.31	1.7161	2.62	1.82
2	4	16	1.723	2.9687	6.892	1.927
3	6	36	2.75	7.5625	16.5	2.675
	12	56	5.783	12.2098	26.012	
Mean x= 4,Mean :y= 1.927,a=0.437,b=0.3725,r= 1.0 t=0.615,p < .50						