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Oviposition Behaviour of *Campanulotes bidentatus compar* (Burmeister, 1838) (Phthiraptera: Ischnocera: Philopteridae)

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Abstract : In the present study oviposition behaviour of small pigeon louse, *Campanulotes bidentatus compar* were described. The location of eggs on the feathers and in demarcated regions of the host body is reported. It is suggested that louse prefer abdomen, back and breast feathers for egg laying. Eggs are generally laid on the lower portion, mostly on after shaft of feathers at an angle of 10-20˚. A single egg is counted on a single feather. Egg laying process and egg morphology were also discussed.

Key Words: Behaviour, *Campanulotes bidentatus compar*, egg, feather, morphology, egg laying, oviposition, pigeon louse.

Introduction

Parasites are generally assumed to negatively affect the well-being of their hosts, particularly during adverse environmental conditions. Ectoparasites such as ticks and lice can cause many diseases to the host, which can even be fatal if parasite burdens are particularly high. The presence of ectoparasites reduces the survivability of the host to some extent (Kumar and Tembhre, 2010). On the other hand egg-laying is a prevailing aspect of the reproductive biology of insects. The pattern of oviposition in insects is considered important factor for providing parental care to their progeny. There is therefore, a serious evolutionary importance on the process of how to lay an egg, and on the decision of when and where to lay an egg (Cury *et al.,* 2019). All birds are considered to harbour some kind of parasite at some stage of their lives, either endo- or ectoparasites. All of these parasites feed on blood, feathers or skin of the passerine host (Rothschild and Clay, 1957).

The order Phthiraptera includes a diverse group of ectoparasites, including different kinds of chewing lice, it is well known for the negative effect of these ectoparasites on the hosts productivity and vitality. A few investigators have provided information on the oviposition sites, pattern of egg laying, pasture adopted during egg laying and structure of eggs of some avian Phthiraptera (Kumar *et al.,* 2006 and Gupta *et al.,* 2004). Studies have shown that egg-laying sites egg morphology, the phases of oviposition and ecological significance of surface topology differ in avian lice (Pfleger, 1929; Richter, 1870; Foster, 1969; Saxena *et al*., 1993). In the present studies an attempt was made to study the egg morphology and oviposition behavior of pigeon louse, *Campanulotes bidentatus compar.*

Materials and Methods

Oviposition behaviour of *C. bidentatus compar* was examined in the temporary anaesthetized infested pigeons. Birds were placed in polythene bags along with the cotton wad soaked in chloroform with the head outside the bag. The body of the host bird was demarcated arbitrary into nine regions (i.e. head, neck, nape, back, breast, abdomen, sides, wings and tail). Feather of each region was examined carefully with the help of a magnifying lens and torch. Posture adopted by lice (female of *C. bidentatus compar*) during egg lying has been recorded by direct observation under a stereozoom trinocular microscope.

Observation

Most preferred oviposition site of *C. bidentatus compar* were found to be feather of the abdomen. They also oviposited on the feather belonging to back and breast. Few numbers of eggs were also counted on the feather of neck and nape while eggs count on other areas (tail and wings) remained nil to negligible. Thus, it is presumed that any specific area was not used by a female for egg laying and oviposition site are widespread. Generally, a single egg has been counted on a single feather. Eggs were glued to lower portion mostly on the fluffy part of the lower part of a feather with the help of thick cementing material. Eggs were laid randomly on the fluffy region. Sometimes, *C. bidentatus compar* lays an egg on the side of after shaft of feather and it inclined at an angle of 10-20˚. It lays egg singly, no cluster of eggs are formed. There is no clear-cut egg laying pattern.

In the beginning of the egg-laying process, female *C. bidentatus compar* crawls on a feather, close to rachis. Female lowers the rear end of her abdomen

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and then presented abdominal contraction. At first, contractions were from side to side and then the tip of abdomen contracts in and out. These movements were supposed to be related to passage of an egg down the female genital tract. Thereafter, it oozes a thick transparent gelatinous substance from the genital opening and raises the abdomen 5-6 times, before passing the egg. After 12-15 seconds of secretion, the egg passes out and implanted in already transuded secretion (Fig.- 1 & 2). After laying an egg, female remain still for about 20 seconds and then moves away. Eggs were adhering with the cementing material on feathers belonging to different body parts of hosts. It has been observed that female of *C. bidentatus compar* laid eggs during daytime (between 12 afternoons to 3 pm) unlike *Falcolipeurus frater* which reportedly lays their egg during the night. The time required by a female to lay the egg has been found to be 1minute 30 seconds.

Fig. - 1: Showing oviposition behaviour of adult female of *Campanulotes bidentatus compar*

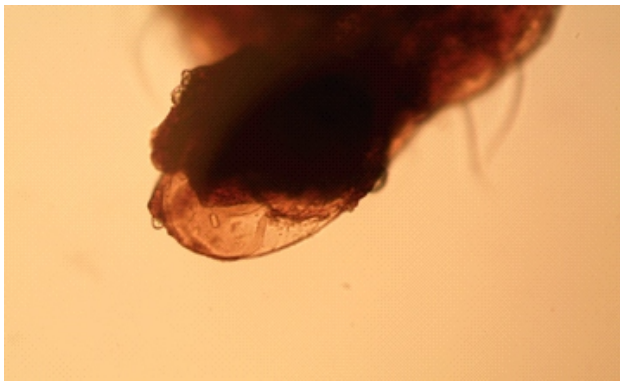

Fig. - 2: Showing egg at the time egg laying of *Campanulotes bidentatus compar*

Fig.-3: Egg of *Campanulotes bidentatus compar*X 120

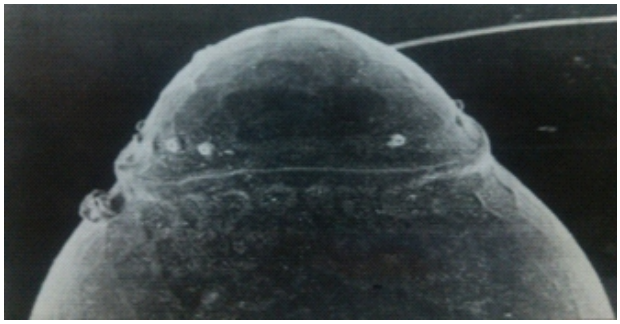

Fig. - 4: Showing operculum of egg of *Campanulotes bidentatus compar* (enlarged) X 330

Fig. - 5: Showing blunt end of egg of *Campanulotes bidentatus compar* (enlarged) X 302

Eggs of *C. bidentatus compar* are small, oval-shaped grain-like structure. It measures 0.55-0.57 mm in length and 0.26-0.28 mm in width (Fig.-3). Their ends were bluntly rounded and were entirely covered by transparent chorion or eggshell. Egg mouth is well marked dome-shaped, a cap like an operculum measuring 0.15-0.17 mm in diameter. Anterior end (near egg mouth) and operculum exhibited slightly defined ridges (not clearly observable) (Fig.- 4). A rim of operculum contains 8 to 10 small micropyles. Egg chorion remains free from any kind of sculpturing/apoplyses or bristles like structure. Thus, egg chorion remains smooth inspite of markings. Any other kind of embellishment on egg shell has not been observed. Neither the egg shell nor operculum has any sorts of epiphyses or filamentous outgrowth. Furthermore, a shell is completely devoid of a spine as reported in other species. The posterior portion of egg remains covered with cementing material (used to glue the egg). Hence, the egg stigma remains concealed in cementing material (Fig.- 5).

Discussion

Phthirapteran species lay eggs and glued them to the host body (Marshall, 1981). Marshall (1981) reported that ovulation occurs due to rhythmic contraction in lateral oviducts and it stimulated by the nervous system. Avian Phthiraptera exhibited some protective feature while selecting a site for ovipostion. Ovipostion is usually confined to the specific area of a host even in those louse species which generally may be found on any other region of host body (Ash, 1960). For instance, *Kelerinirmus regalis* oviposit upto 160 eggs per feather on the upper side of covert feathers of lower wings of its host (Clay and Rothschild, 1938). *Columbicola columbae* lays its egg in small plumage and *Trimenopon hispidium* prefer sides of the head of its (Eichler, 1963). *Riccinus picturatus* oviposite its eggs on contour feather in submaler, ventral, cervical region and *Philopterus* species eggs are confined to the ventral shaft of contour feather of an anterior submaler region of orange-crowned warbler (Foster, 1969). *Menacanthus stramineus* prefer feather of a chin, gular and nape region while *M. cornutus* utilizes feather of crown and neck region (Saxena *et al*., 1993). *Falcolipeurus frater* prefers a dorsal side of wings feather (Agarwal, 1967). *Myrsidea amandava* lays egg on head and neck feather and *Brueelia amandava* oviposit eggs on breast, back and abdomen region (Gupta *et al.,* 2004), *Sturnidoeceus bannoo* select head, neck and nape feather (Rajput, 2009), *M. cornutus* eggs are found on neck, head and nape regions (Kumar, 2010), *C. columbae* prefer wings and tail feather for oviposition (Singh *et al*., 2010), *Hohorstiella rampurensis* prefer to lay eggs on nape, neck and head region (Singh *et al*., 2016). Moreover, Phthiraptera species have a very peculiar egg-laying site and patterns. The amblyceran species *Actornithopilus patellatus* glue their eggs inside the shaft of primary or secondary feather whereas *Piagetiella titans* live in gular pouches of Blagovestchensky (1955 and 1959), Eichler (1950 and 1963), Arora and Chopra (1959) and Agarwal and Saxena (1982). Egg laying pattern of phthirapteran ectoparasites on the host body was also documented by some workers. Ischnoceran species e.g. *Columbicola columbae* (Singh *et al*., 2000), *Anaticola crassicornis* (Kumar *et al*., 2003) and *Ardeicola expallidus* (Ahmad *et al*., 2010) mostly oviposit their eggs within furrow present between adjacent barbs of wings feathers. Few phthirapteran species glued their eggs in regular pattern on proximal portion of rachis (e.g. *Hohorstiella lata* and *Myrsidea amandava*) (Nelson and Murray, 1971, Singh *et al*., 2000 and Gupta *et al*., 2004) whereas certain other lice species (e.g. *Lipeurus caponis, L. heterographus, Goniocotes gallinae, Philopterus lahorensis, Brueelia amandava*) place their eggs in haphazardly on different portion of vane of feathers (Beg *et al*., 2004, Gupta *et al*., 2004 and Kumar *et al*., 2006). Some amblyceran species lay eggs in clusterous fashion on single feather which appeared to be irregular bunches e.g. *Allocolpocephalum fragile* and *Menacanthus stramineus* (Beg *et al*., 2004 and Kumar *et al*., 2006).

Phthirapteran species also show wide variation in angling orientation of eggs with feather surface. Some group of lice e.g. *M. gallinae, G. dissimilis, M. stramineus, S. banno, H. lata* and *C. bidentatus compar* (Kumar *et al*., 2006, Rajput, 2009, Nelson and Murray, 1971) glued their eggs through posterior ends while other species like *Allocolpocephallum fragilis, B. ginginianus* and *M. eurysternus* glued their eggs posterolaterally (Singh *et al*., 2000, Beg *et al*., 2004 and Rajput, 2009). Selected workers also try to get information about secretion gland of phthirapteran females. Marshall (1981) examined the reproductive system of *L. lawrensis tropicalis* but did not find the presence of accessory gland. However, lateral oviducts of this louse contain numerous protuberances lodging 4-6 glandular cells which are responsible for secreting adhesive material (Saxena and Agarwal, 1980).

Phthirapterans also exhibited variation in eggs count on a particular feather. Some lice species preferred to lay a single egg on a single feather while other places a huge number of eggs on an individual feather. For instance, *Lipeurus lawrensis tropicalis* and *Ciconiphilus decimfasciatus* glued up to 500 egg on a single feather whereas *C. turbinatum* laid 1000 eggs on a single feather (Nelson and Murray, 1971, Kumar *et al*., 2006 and Ahmad *et al*., 2010), *M. cornutus* laid

209 egg on a single feather (Kumar *et al*., 2010).

Egg morphology of lice fascinates some workers. Marked differences in egg morphology of even intragenic species have been observed. Balter (1968b) has stated that egg morphology could be used for lice classification at genus and species level. Such structural difference in egg morphology of different phthirapteran species has also been reported by Denny (1842), Saxena *et al*. (1994), Sharma (1995), Kumar *et al*. (2007), Kumar *et al*. (2010) also suggested that egg morphology could be used for preparation of taxonomic key for identification of both genera and species. Blagovesthchensky (1955 and 1959), Eichler (1950 and 1963), Hohorst (1939), Balter (1968a and b), Eichler *et al*. (1974), Saxena *et al*. (1993, 1994 and 1995), Zawadzka *et al*. (1997), Cicchino and Mey (2007) and Kumar (2010) has provided some useful information on egg morphology of phthirapteran species. Literature reveals that phthirapteran eggs are generally oval-shaped polymorphous structure. They exhibit quite variable external forms and sculpturing (Chequered, apophyses etc.). Nature of egg shell of different species belonging to some genus have been reported in case of *Menacanthus* (e.g. *M. stramineus, M. gonophaeus, M. cornutus* and *M. abdominalis*) by some workers like Balter (1968a and b), Kumar *et al*. (2007) and Gupta *et al*. (2009). Egg shell of *Menacanthus* species shows a difference in nature of apophyses, polar thread, opercular disc and micropyles. On the other hand, an egg of genus *Hohorstiella* is concerned, one species (*H. lata*) bore numerous spines like apophyses while in other (*H. rampuarensis*) apophyses were present only on one side of egg shell (Saxena *et al*., 2000 and Singh *et al*., 2016).

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