



Feeding behaviour of *Campanulotes bidentatus compar* (Burmeister, 1838) (Insecta, Phthiraptera, Mallophaga, Ischnocera)

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Abstract

Feeding behaviour helps in determining various aspects of an organism. Phthirapteran species show diversified and controversial feeding habit. Feeding habit of *Campanulotes bidentatus compar* has been determined by observing live lice in *in-vitro* condition. Crop content of dead lice is also examined. Louse mostly feeds upon barbules of feather but never takes on pellicle of skin, scurf, epidermal scales and sheaths of a growing feather. Any triturating agent has not been recorded. Any sex or stage related difference in feeding habit has not been found. Presence of host blood in crop content has not been detected. It has been observed that sometimes it feed upon its own eggs as well as eggs of other species. Louse involved in cannibalism and hyperparasitism.

Keywords: behaviour, *Campanulotes bidentatus compar*, cannibalism, feather, feeding, phthiraptera

Introduction

Phthirapteran ectoparasites show quite diversified and controversial feeding habit. Few (members of Philopteridae) are purely feather feeders while others (member of Menoponidae) nourish on blood along with skin derivatives. Members of Gyropidae are habitually haematophagus and do not survive in absence of host blood. Furthermore, certain other species prefer highly variable feeding habits such as *Dennyus* species nourish upon liquid secretion of an eye of the host (Rothschild and Clay, 1952) [14] and *Piagetiella* species habitat in pouches of Pelecaniformes, eventually feeds upon blood mucus and skin debris (Dubinin, 1947) [9]. Some species (e.g. members of Menoponidae) takes blood in varying degree. Some workers (i.e. Wilson, 1933; Crutchfield and Hixson, 1943 and Kalamarz, 1963a and b) [23, 8, 10, 11] reported the haematophagus nature of *Menacanthus stramineus* and *Menopon gallinae* which later confirmed by Crystal Teichman method and by contact autoradiography (using Fe⁵⁹ isotope).

Blood feeding habit of *Menacanthus eurysternus* (Agarwal *et al.* 1983) [15, 3], *Trinoton anserium* (Seager *et al.* 1976) [17], *T. querquellidule* (Saxena *et al.* 1985) [16], *Heterodxus spinger* (Agarwal *et al.* 1982) [2], *Hohorstiella lata* (Brown, 1970) [7] have also reported. On the other hand, some other phthirapteran species (members of Trichodectidae infesting mammals) feeds upon the skin, scurf, epidermal scales and other epidermal derivatives (excluding hair). Furthermore, many mammalian lice (e.g. *Bovicola bovis*, *B. ovis*, *B. crassipes*, *B. limbata* and *B. equi*) have been reared on a diet from host skin scrapping and brewer's yeast (Saxena and Agarwal, 1983) [3, 15]. Exceptionally member of Trichodectidae (e.g. *Trichodectes canis*) show haematophagous feeding habit (Bouvier, 1945). Moreover, information regarding the food habit of many avian lice is also available. Haematophagus nature of some poultry lice (*M. stramineus* and *M. gallinae*) have already discussed above *M. cornutus* has also found to be haematophagus

(Trivedi *et al.* 1990) [21] on the other hand *Lipeurus caponis*, *Gonicotes gallinae* and *G. hologaster* feeds on barbs and barbules of host feather (Crutchfield and Hixson, 1943) [8], *L. tropicalis* and *L. lawrensis tropicalis* takes on fragments of feather, loose scruff, pellicle of skin, sheaths growings feather and sometimes coagulated blood (Arora and Chopra, 1959, Agarwal and Saxena, 1980) [5, 1].

Information about feeding behaviour of other avian and mammalian phthirapteran species was also available (Nelson, 1972; Seager *et al.* 1976; Agarwal *et al.* 1982 and 1983 and Saxena *et al.* 1985) [13, 17, 2, 16]. In the present study, an attempt has been made to record the nature of crop content and made of ingestion of barbules in case of pigeon louse, *Campanulotes bidentatus compar*.

Materials and Methods

To study the crop content of *C. bidentatus compar*, fresh lice obtained from infested birds were dissected in insect ringer's solution. The whole alimentary canal was taken out and teased with the help of fine needle on a glass slide and studied under the stereozoom trinocular microscope. Furthermore, few numbers of crops were dissected out separately and put out into different grades of alcohol for dehydration and then stained with eosin and cleared in xylene and then teased before mounting. Mechanism of barbules intake has been reported by direct examination under a stereozoom binocular microscope.

Furthermore, live lice *in vitro* condition were also examined under a stereozoom trinocular microscope while they are feeding a different kind of food material.

Observation

Feeding habit of *C. bidentatus compar* was observed by microscopic examination of crop contents of lice of all stages and sexes (including male, female and different instars). Results indicate that the crop of well-fed louse is found filled with nearly uniform sized barbules. There found to be very negligible difference in a crop of different

instars of nymphs and adults of both sexes. During *in vitro* experimentation, *C. bidentatus compar* survive comfortably on feather diet which indicates that it is a non-haematophagus. An attempt has also been made to induce given louse to ingest bloodstained feathers but it did not show any interest. Moreover, fresh pin feather obtained from young birds/shaft of which were filled with blood and pulp, were also offered to these lice (as done in case of haematophagus/partly haematophagus like *Menacanthus stramineus* and *Menopon gallinae* etc. to fulfill their nutritional requirement).

An attempt was also made to record the mechanism of ingested of feather barbules by direct observation under a stereozoom binocular microscope. Lice which preparative to feeding, first hold the feather barb with the help of meso and metathoracic legs and uses prothoracic legs to hold a single feather barbules or barb which is then forced into the oral cavity by downward and backward movement of pulvinus, maxillae help in acquiring the barbules in oral cavity, while shaped edged mandibles help in cutting the barbules into small pieces. Finally, these barbules are pushed inside the mouth by labrum. The crop of lice was entirely packed with uniformly sized barbules (Plate- 1). These ingested barbules set one after the other, are passed into crop through pharynx and oesophagus and get arranged in a lengthwise manner. Regular movement of a crop can be observed from outside under a microscope. It seemed that an anti-peristaltic movement arises at the posterior end of a crop at regular interval which is followed by peristaltic movement in opposite direction. The anterior end of a crop of most of the phthirapterans contains a group of crop-teeth which varying number and sizes are arranged in rows (Plate- 2). Antero-dorsal wall of a crop of *C. bidentatus compar* internally bears 15-17 rows of teeth (Fig. 1) attached to crop wall (in the area measuring 200-265 μm in length and 20-60 μm in width) with their broad bases (pointed and hanging freely in crop lumen) (Plate-3). The number of teeth varies from 2 to 10 in each group and size of teeth ranges from 4-9 μm in length and 1.5-3 μm in width at the bases. Crop teeth presumptively responsible for trituration of feather barbules when later rubbed against teeth during movement of a crop.

A crop of *C. bidentatus compar* is elongated pear-shaped blind sac (typically ischnoceran type), elastic in nature and able to accommodate plenty of such pieces of barbules. Furthermore, crop undergoes regular peristaltic movement due to which the tips of barbules are rubbed against the group of crop teeth present at the anterior end of the crop wall.

However, examination of crop contents reveals that they mostly feed upon the barbules of a feather. Presence of pellicles of skin, sheaths of a growing feather, scurf's and epidermal seals have never been detected during an investigation. Moreover, the presence of any trituration agents like quartz, mica, sand, grain, seed coats and fungus spore has not been recorded. Furthermore, some small pieces of chitinous egg shell were also present in two crops. Direct observation of the microscope showed that *C. bidentatus compar* feeds upon own egg as well as eggs of other species. Hence, this louse showed cannibalism and also hyperparasitism.

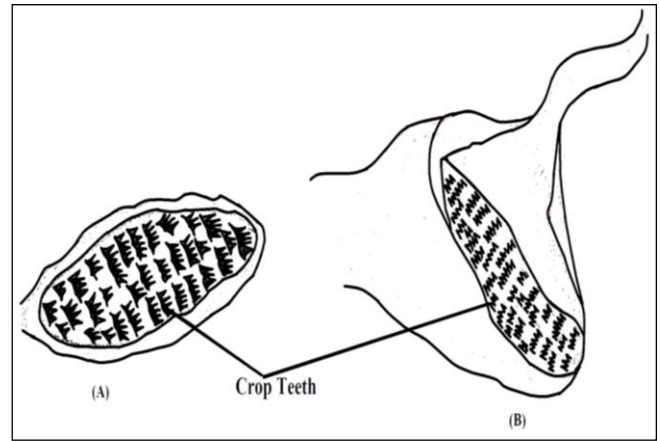


Fig 1: Showing (A) Crop Teeth and (B) Crop of *Campanulotes bidentatus compar*

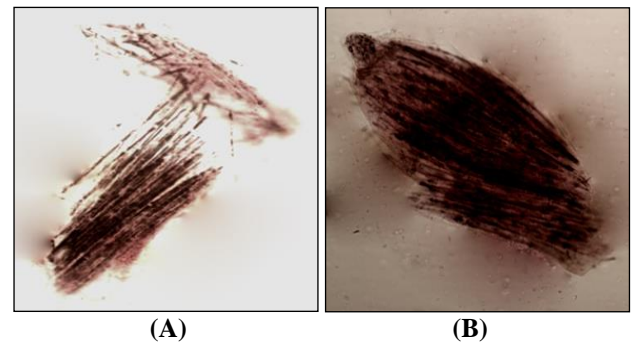


Plate 1: Showing Arrangement of Feather Barbules in Crop of *Campanulotes bidentatus compar* X 65 (A) and 69(B)

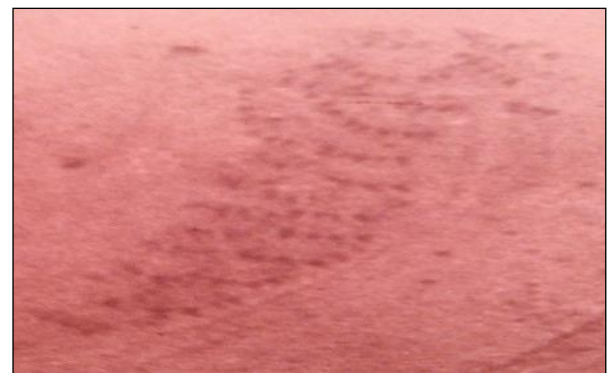


Plate 2: Showing Arrangement of Crop Teeth in Crop of *Campanulotes bidentatus compar* X 132

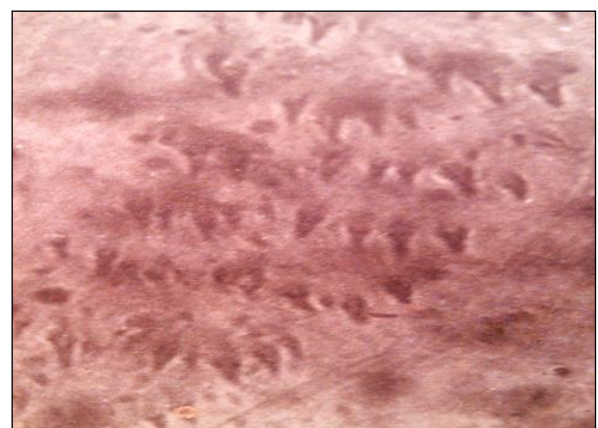


Plate 3: Showing Structure Crop Teeth of *Campanulotes bidentatus compar* X 650

Discussion

Phthirapterist has a continuous argument regarding the feeding habit of Mallophagan species. In earlier 1926, Waterson stated that for mallophagan species nothing seems to be amiss as food and found protective sheaths of feather, feather fibers, skin scrabs, scruff, granules of quartz, mica, sand, grain seed coat, fungus spore, cuticular process and blood (if accessible) from the crop of phthirapteran species, *Esthiopterum monile* infesting vulture.

Feeding habit of *C. bidentatus compar* is reported specific as they are found to be purely feather feeder and occasionally feeds on own eggs. Its feeding habit did not resemble with that of *C. columbae*, *Lipeurus lawrensis tropicalis*, *L. caponis*, *L. tropicalis*, *Goniodes gigas*, *G. hologaster* and *G. dissimilis* which normally take feather barbs, barbules sometime skin scuff, epidermal scales, sheaths of growth feathers, pellicles of skin and occasionally the coagulated blood (Crutchfield and Hixon, 1943; Arora and Chopra, 1957, Agarwal and Saxena, 1980, Sharma, 1995 and Singh *et al.* 2010)^[8, 4, 18, 1, 19]. Yet this species does not take blood meal (Kalamarz, 1963a)^[10]. *C. bidentatus compar* never takes any trituration agents like granules like granules of quartz, mica, sand, grain, seed coat and fungus spore etc. as recorded by Waterson, 1926 in case of *Esthiopterum monile* infesting vulture. It also involved in cannibalism as no egg shell, cast skin or any other body parts detected in its crop contents. Nelson (1971)^[12] reported that amblyceran pigeon louse, *Colpocephalum turbinatum* feeds on their own eggs and 80% nymphs of one generation were eaten up by their adults *in vitro*. *C. turbinatum* also ingest entire eggs except for a cemented portion along with nymphs while chorions of hatched eggs, dead nymphs and cast skin were not consumed. However, such behaviour of cannibalism and predation is also displayed by *C. bidentatus compar*. Moreover, any sex and stage related difference in feeding behaviour has not been reported. On other hands, Srivastava and Agarwal (1981)^[1] noted that adult female and nymphs of *Laemobothrion perchopteri* are haematophagic while a male is not.

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