Seasonal changes in the population of *Menacanthus cornutus* (Phthiraptera: Amblycera)

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Abstract The chicken body louse, *Menacanthus cornutus* (Menoponidae s.l.) completes its whole life cycle on the body of *Gallus gallus domesticus*. The louse exploits the microclimate developed by host skin temperature and feather cover. The weekly visual examination has demonstrated the pronounced response on the population fluctuation of *M. cornutus* to the seasonal changes in the environment despite all favourable condition on the body of homothermic host. The experiments commences from April 2008. The peak index was obtained in the month of August followed by drastically decline in succeeding 5 months. Lice index begins building up slowly from the months of February and March. The correlation between mean monthly lice indices with temperature and photoperiod were analyses as strong positive. The moderate positive correlation was found with relative humidity and it remained insignificant with rainfall.

Keywords Phthiraptera · Ectoparasite · Mallophaga · Domestic fowl · Menoponidae

Introduction

Phthirapteran ectoparasites are adapted to warm and humid microclimate developed by the host feather or hair or coat of wooly mammals. The change in environmental factor (i.e. temperature, relative humidity, rainfall, photoperiod etc.) is reflected by population build up on parasitizing host body (Von Keler 1969). Thorough look on literature have

revealed that study on avian lice population response to seasonality have been documented by Boyd (1951), Woodman and Dicke (1954), Ash (1960), Touleshkov (1965), Baum (1968), Foster (1969), Eveleigh and Threlfall (1976), Agarwal and Saxena (1979) and Chandra et al. (1988, 1990). Furthermore, seasonal changes in mammalian phthirapteran have been studied by Craufurd-Benson (1941), Matthyse (1946), Cowan (1946), Scott (1952), Allen and Dicke (1954), Murray (1957, 1960, 1963, 1968), Anderson (1962), Murray and Gordon (1969), Samuel and Trainer (1971), Amin and Madbouly (1973), Rust (1974), Rawat and Saxena (1990, 1992) and Kumar et al. (1993). A majority of above workers have noted that mammalian lice are generally exhibited peak intensity of infestation in the winter months while the avian lice are found maximum in the summer months. *Menacanthus cornutus* is haematophagous and very fast runner on the skin. This poultry louse is least encountered by phthirapterists of the world. The seasonal changes in the population of *M. cornutus* have been unstudied so far. Keeping in view, authors have made an attempt to record the population fluctuation of *M. cornutus* on domestic fowl (*Gallus gallus domesticus*).

Materials and methods

The study was conducted on a flock of six fowls (one male and five females) having age group of 7–9 months at the commencement of the experiment. The experiments were accomplished from April 2008 to March 2009 at Purola (Uttarkashi, India). The flock had only infestation of *M. cornutus*. The birds were maintaining ad-labium throughout the year in changing climatic conditions in wooden cage. The feed (wheat, rice, grinded maize etc.), water and similar hygienic condition have been provided to

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fowls till the completion of experiment. The domestic fowls were of brown leg horn breed.

Each bird was examined weekly with the help of magnifying torch, to record the lice index by gently deflecting feathers so that birds do not get any injury. The counting of lice on each bird have been made for 5 min and selected body parts were searched out for lice which were far visited by *M. cornutus*. The degree of correlation between mean monthly lice indices and four ecofactors (i.e. Temperature, relative humidity, rainfall and photoperiod) have been analysed.

Results

The chicken body louse, *M. cornutus* is a very fast runner over the skin of host among all amblyceran species infesting domestic fowl and seldom visited the feathers of host. The mean monthly lice index was recorded 23.67 in the month April 2008 (Fig. 1). Thereafter, sharp decline was recorded in the month of May (15.88), when least humidity was recorded in and around Purola. Furthermore, lice index increases in next 2 months (June-23.25 and July-28.39). The peak index was obtained in the month of August (41) when humidity and temperature might be optimum. The lice index in next 4 months (e.g. September, October, November and December) showed regular decreasing trend (23.8, 21.75, 17.35 and 14.05 respectively) (Fig. 1). This ectoparasite found to be very sensitive to low environmental temperature. The lowest lice index was recorded in the month of January (1.95) while the mean monthly temperature was also least and had sufficient humidity. Lice index begins building up slowly from the months of February and March (3.87, 9.7) (Fig. 1). These months exhibited little increase in temperature and fast

decrease in humidity, which support the population build up. The correlation between mean monthly lice indices and four ecofactors were also analyses statistically. The strong positive correlation existed between lice indices and mean monthly temperature as well as lice index and photoperiod ($r_{12} = +0.77$ and $r_{15} = +80$). The correlation between lice indices and R.H. remain insignificant ($r_{13} = +0.19$). While the moderate positive correlation recorded between lice indices and rainfall ($r_{14} = +0.57$).

Discussion

The present study has made it more affirmed that population of *M. cornutus* respond profoundly to change in environmental factors. The temperature is the vital abiotic factor responsible for the abundance of *M. cornutus*. The rain might change the ambient humidity of birds and affect the population of *M. cornutus*. Kettle and Luckies (1982) have documented that heavy rain fall causing saturation of fleece in the autumn which reduce the louse population and also keep a check on winter infestation.

Baum (1968) has pointed out that there is no variation in population density of amblyceran as well as of ischnoceran species with the change in environmental factor (e.g. temperature, RH, rainfall and day light). Moreover, Von Keler (1969) has clearly cited the change in mallophagan population density (highest in summer and lowest in spring as well as in winter). Conversely to avian lice, mammalian lice infestation is peak in winter. Murray (1960, 1968) has reported that atmospheric temperature, shearing, solar radiation and thunderstorms are responsible for the summer decline in the population of sheep louse, *Bovicola ovis*. Furthermore, the shedding of winter coat and higher temperature in summer play critical role in reducing the

Fig. 1 Showing the seasonal changes in the population of *M. cornutus* in relation to four ecofactors during 2008–09

number of *B. equi* on horses (Murray 1957, 1963). The infestation intensity of *Tricholipurus parallelus* on white tailed knock down in summer due to moulting, higher summer temperature and thunderstorms (Samuel and Trainer 1971). The temperature and ambient humidity (microclimate) of host's body and sunlight considered as important factor for shaping the population build up of *B. bovis* on cattles (Craufurd-Benson 1941; Matthyse 1946). Birds and mammals in summer have often seen bathing with water and this might have caused delousing effect. Felso and Rozsa (2006, 2007) have documented that birds and mammals dividing behaviour reduces genera richness of avian and mammalian lice. The birds preening behaviour has also affect the lice population (Brown 1972; Clayton et al. 1999). Those birds cannot preen significantly having huge increase in their louse population (Moyer and Clayton 2004).

In the present study it has been noted that allopreening has important effect on controlling amblyceran lice on domestic fowl. The amblyceran lice, *M. cornutus* and *M. stramineus* lays eggs mostly in the neck region. The small contour feather of neck and nape are fully covered with eggs. The pen mates peck the egg containing feathers of each other and feed them. Furthermore, the population density of lice varied with the host health aspect. Those birds can't scratch head and neck region due to serious leg injury, the number of lice and nits increases on these regions. However, other parts of body were unaffected which can still preen (Clayton et al. 1999). The birds bear cumbersome lice load because of deformities in their beak than to birds with normal beak (Pomeroy 1962; Clayton et al. 1999). Bell et al. (1962) have presented that the fore parts of mice have huge lice density due to non significant scratching because mice has missed toe of hind legs. James et al. (1998) demonstrated that a crippled lamb (bottle fed) acts as major source of lice on a particular property. Bates (2001) has noted in United Kingdom the high louse count on the sheep which had liver fluke (*Faciola hepatica*) infestation. James et al. (1998) reported that group of ewes clinically diagnosed with ovine progressive pneumonia serving as rich source of lice to healthier one.

Through scrutiny of literature has possessed that some lice shows synchronization with host (Marshall 1981). The population increase of haematophagous species triggered with the host breeding seasons (Foster 1969). She further postulated that this increases in louse population may be due to host reproductive hormones. Srivastava et al. (2003) have analysed path coefficient of correlation between the breeding cycle of common myna (*Acridotheris tristis*) and its three phthirapteran ectoparasites (*Menacanthus eurysternus*, *Brueelia* sp. and *Sternedocus* sp.). However, there is no particular breeding season in case of *Gallus gallus domesticus* but incubating hen might exhibit higher

population level. The lice population of domestic birds may also be affected by predatory mites and hyperparasites (bacteria and fungi) (Marshall 1981).

The present observation are more or less similar to Woodman and Dicke (1954) for *Brueelia vulgata* infesting sparrows, Touleshkov (1965) on few mallophagan species infesting *Sturnus vulgaris*, Eveleigh and Threlfall (1976) on several species of *Saemundssonium cummingsiella* and *Astromenopon* infesting auks and by Agarwal and Saxena (1979) on *Lipeurus lawrensis tropicalis* parasitizing *G. gallus domesticus*. In the present study it is quite clear from Fig. 1 that lice population increases seasonally. The population of *M. cornutus* builds up in spring, reaching peak in summer to autumn thereafter, decline and remaining low throughout the winter investigation. Thus high temperature and humid climate are favorable for the lice fluctuation. Such condition occurs in the months of July and August at Purola (India) and its adjoining areas. So, such lice may increase above economic injury level in the summer month. Keeping in view, one should be careful about higher population level of this injurious pest and they should be suggested for proper eradication of *M. cornutus*. Finally, present investigation and earlier workers agree that strong positive correlation (+0.75) existed between lice index and temperature. So, it might be predicted that global warming might increase the population on domestic and wild birds which would be most menacing for the avian biodiversity in future.

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