

A NOTE ON THE *IN VITRO* STUDIES OF THE CHEWING-LICE (PHTHIRAPTERA)

By

R. K. RAI

Zoological Survey of India
Eastern Regional Station, Shillong
 and

K. V. LAKSHMINARAYANA X

Zoological Survey of India, Calcutta

It is well known that in certain cases where sibling species are involved, the conventional morphological attributes of the adults may not help us in their identification, and one has to look to other criteria like the larval morphology behaviour, feeding habits, etc. While the study of developmental stages may be easy with other groups, it is not so in case of obligatory parasites like the 'chewing-lice' which show high degree of not only the host-specificity, but also niche-specificity. The life-span of individuals outside the host has been found insignificantly small, and is one of the reasons why these parasites rarely infest other hosts and secondarily establish on them. Another reason is their extreme food preference for the plumage or pelage of the natural host. Therefore, the biology and the nymphal taxonomy of very few species only are known and we know nothing of a very many species, especially those inhabiting non-domesticated host groups. Unfortunately, most of our laboratory collections also include only the adults, and rarely we find even a single nymph for examination, or collectors may ignore the juveniles while making the collections. At times, we do come across the nymphal instars and also the eggs or nits. In such cases, we may not be able to correlate them with their adult stages, unless they are also collected along with the nymphs, or when more than one species (say a sympatric one) harbours the host. We have no alternative than to rear them for study in the laboratory and the following will give a general outline of the requirements for the *in vitro* culture of the chewing-lice.

I. TEMPERATURE

Temperature plays an important role in *in vitro* culture, since the lice are very much conditioned to the host feather or hair cover which

insulates them from the external atmospheric fluctuations in the temperature. The lice occupy different levels of the host body, as for example, under the feather cover, which varies from species to species and also for different nymphal instars and the eggs (Ash, 1960). Ash (*op. cit.*) also states that the actual skin temperature and at different levels of the feather cover differ from each other. Ignoring these facts might have been one of the reasons for the failure of the *in vitro* cultures. The temperature requirement varies from species to species. For example, Agarwal (1967) successfully bred *Falcolipeurus frater* (Giebel) at 33°C. ($\pm 0.5^\circ\text{C}$.), 33°C.-34°C. for *Cuclotogaster heterographus* (Nitzsch) (Wilson, 1934), 32°C.-33°C., for *Lipeurus caponis* Linne (Wilson, 1939), 37.5°C., for *Philopterus citrinellae* (Schrank), and *P. turdi* Denny (Ash, 1960), 30°C.-40°C., for *Goniodes colchici* (Denny) (Williams, 1970 a, b), 35°C., for *L. tropicalis* Peters (Arora and Chopra, 1959), and 32°C.-37°C., for *Colpocephalum turbinatum* Denny (Nelson, 1971). Rakshapal (1959) fixed the thermopreferences of *Columbicola columbae* (Linne) lie between 33°C.-36°C., and Bair (1950) calculated it as 42.49°C.-0.34°C., for *Cuclotogaster heterographus* (Nitzsch) (see Wilson, 1934) and that the optimum culture temperature lies in the vicinity of 42°C., while the average skin temperature of the head and neck of the host where the parasites are found as 41.5°C. Both these latter authors have outlined the devices they used for selecting the temperature preferences of the species. We may reasonably assume that the avian infesting forms (not of the water inhabiting hosts) in general require 30°-42°C. While most of the studies have been centred round the Ischnocerophthirina, Nelson (1971) very successfully bred Amblycerophthirina.

II. HUMIDITY

Williams (1970 a,b) rightly pointed that the humidity requirements of the chewing-lice are little known. This author considers the threshold of relative humidity (R. H.) is around 60% and that most *in vitro* cultures can be maintained at 80% R. H. It is interesting to investigate the water conservation mechanism or source of water supply in the chewing-lice.

III. FOOD SUPPLY

The Ischnocerophthirina and Amblycerophthirina are mostly feather or hair feeders and the latter sometimes ingest blood also. The Rhynchophthirina like the sucking-lice (Siphunculophthirina) takes

blood and sebaceous matter. As already stated, the chewing-lice or niche—, and host-specific. Therefore, these lice do not feed on the feathers from other regions of the host body than of its usual ones, or from other hosts. Ash (1960) however, stated that they may live in one niche, but may feed on feathers of other regions. The voracious feeding and destruction to the wool in the sheep is a well known phenomenon. Ash (1960) reported that feathers of other hosts and other feathers (and not the usual ones on which they normally feed) may either lead to the death of the parasite, or if forcibly fed on the altered food, it fails to breed. Wilson (1934) though stated that *Cuclotogaster heterographus* (Nitzsch) from the hen feed and digest the feathers of Little green heron, his results indicate that the cycle has not been completed in any of the cases referred to by him. Mukherji and Sen-Sarma (1955) stated that *Haematomyzus elephantis* Piaget does not survive for more than 3 hrs, if separated from the elephant host and kept in glass vials or transferred on to the guinea-pig or other mammals. Therefore, for a proper maintenance of an *in vitro* culture, one has to provide the correct feed for the parasite, failing which the culture cannot be maintained for long. Nelson (1971) reported that *Colpocephalum turbinatum* Denny predate its own eggs and juvenile stages and this may be one of the limiting factors for a successful maintenance of the *in vitro* culture.

No serious attempts have so far been made on artificial diet feeding, and if we succeed in it, it will be a major break-through for *in vitro* culture of the chewing-lice. Perhaps, *Ischnocrophthirina* may be induced to feed on artificial diets in the form of flakes.

IV. EQUIPMENT

At present it is possible to rear the chewing-lice at least for few generations with the following set up.

a. An incubator with thermostat control, which can be suitably fixed between 30°C.-40°C. ($\pm 5^\circ\text{C}.$); the actual temperature tolerance can be found out by trial and error method or by methods suggested by Rakshpal (*op. cit.*), or Bair (*op. cit.*).

b. Water in a wide mouthed beaker or pan for providing required humidity. Williams (*op. cit.*) gave details of another technique for balanced humidity.

c. The lice may be kept in petri-dishes with the appropriate food. The food should be periodically replenished and examined for eggs and nymphs. Nelson (*op. cit.*) considers healthy colonies can be maintained, if the examination schedule is not too close in between each. The soft feathers are usually preferred as the food and wing-feathers for egg-laying purposes be provided. The eggs are laid on the dorsal grooves of the rami and therefore one has to look for them there. Williams (1970a, b) and Nelson (1971) also detailed the methods of arranging the feathers, simulating the bird.

d. When a new culture is raised, it is preferable to leave both the sexes in the petri dishes, (although cases of probable parthenogenesis are known) for successful egg laying.

ACKNOWLEDGEMENTS

The authors thank the Director of the Zoological Survey of India for encouragement. The first author (R.K.R.) also wishes to thank his senior colleague Dr. Asket Singh, Deputy Director, Eastern Regional Station, Z.S.I., Shillong, and Dr. G. P. Agarwal, Reader, Division of Parasitology, Zoology Department, Banaras Hindu University, Varanasi, for his initial training on Phthiraptera studies.

REFERENCES

- AGARWAL, G. P. 1967. Studies on the bionomics and life-history of *Falcolipeurus frater* (Giebel, 1874) (Mallophaga : Ischnocera). — *The Indian J. Zoot.*, 8(1) : 21-40, 14 figs.
- ARORA, G. L. & CHOPRA, N. P. 1957. Some observations on the biology of *Lipeurus tropicalis* Peters — *Res. Bull. Punjab Univ.*, 130 : 485-491.
- ASH, J. 1960. A study of the Mallophaga of birds with particular reference to their ecology. — *Ibis.*, 102 : 93-110.
- BAIR, T. D. 1950. Experimental determination of the autoselected temperature in chicken louse, *Cuclotogaster heterographus* (Nitzsch). — *Ecology*, 31 : 474-477.

- MUKHERJI, D. D. & SEN-SARMA, P. 1955. Anatomy and affinity of the elephant louse (*Haematomyzus elephantis* Piaget, Insecta, Rhynchophthiraptera). — *Parasitology*, 45 (1/2) : 5-30, 40 figs.
- NELSON, B. C. 1971. Successful rearing of *Colpocephalum turbinatum* (Phthiraptera). — *Nature New Biology*, 232 (34) : 255.
- WILLIAMS, R. T. 1970a,b. *In vitro* studies on the environmental biology of *Goniodes colchici* (Denny) (Mallophaga : Ischnocera) I. The effects of temperature and humidity on the bionomics of *G. colchici*. — *Austral. J. Zool.*, 18 (4) : 379-389. II. The effects of temperature and humidity on water loss. — *Ibid.*, 18 (4) : 391-398.
- WILSON, F. H. 1934. The life-history and bionomics of *Lipeurus heterographus* (Nitzsch). — *J. Parasit.*, 20 : 304-311, 2 figs.
- WILSON, F. H. 1939. The life-history and bionomics of *Lipeurus caponis* (Linn.). — *Ann. ent. Soc. Amer.*, 32 : 318-321.
- RAKSHAPAL, R. 1959. On the behaviour of pigeon louse, *Columbicola columbae* Linn. (Mallophaga). — *Parasitology*, 49 (1/2) : 232-241.