

Description of life-history stages of poultry shaft louse, *Menopon gallinae* (Phthiraptera: Amblycera, Menoponidae)

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With 3 Figures

Introduction

Morphological features of adult forms are generally used in systematic and faunistic studies on Amblycera and Ischnocera (Phthiraptera). The nymphal instars (so called »larvae«) are difficult to differentiate, particularly within one or related genera. Since, the three nymphal stages of same species are considerably similar (excepting the size), their identification is also a difficult task. Only few workers have performed specific studies on the morphology of nymphs of selected amblyceran and ischnoceran species. While dealing with the biology of ischnoceran species, workers like, MARTIN (1934), WILSON (1939), CONCI (1956 a, b), ARORA & CHOPRA (1959), and AGARWAL (1967) provided information about nymphal morphology of selected species. Publications of KESSEL (1942), EICHLER (1948, 1963), v. KÉLER (1952), and CONCI (1952) are also quite informative in this respect. Specific studies on nymphal morphology of selected species have been made by CLAY (1958) and MODRZEJEWSKA & ZŁOTORZYCKA (1987). Based on the comparative external morphology of adults and nymphal stages MEY (1994) makes a first comprehensive attempt to deduce the phylogeny of ischnoceran bird biting lice (86 species of 51 genera). Studies on nymphal morphology of two mammalian species, *Trichodectes canis* and *Cervicola meyeri*, have also been made (CRYSTAL 1949, PIOTROWSKI & KADULSKI 1970). Furthermore, the surface ultrastructure of selected species has been recorded with the help of SEM (ZŁOTORZYCKA 1990, ZŁOTORZYCKA & MODRZEJEWSKA 1992, ZŁOTORZYCKA *et al.* 1995). In the present study, an attempt has been made to provide description of three instars of nymphs of poultry shaft louse, *Menopon gallinae* (L., 1758).

Material and Method

First instar nymphs were obtained by incubating the freshly laid eggs of *Menopon gallinae* at 35 ± 1 °C and 75% R. H. for 4-5 days. Second and third instar nymphs were obtained by rearing fresh looking healthier first and second instars respectively (under above said conditions). The newly moulted nymph so obtained were treated with 10% KOH, for 10-12 hours and then transferred to water, following by 10% acetic acid. Then, the specimens were subjected to dehydration, clearing (in clove oil). Few specimens were stained in safranin. Temporary mounts (in glycerin) were also used for recording the correct chaetotaxy of three instars of nymphs.

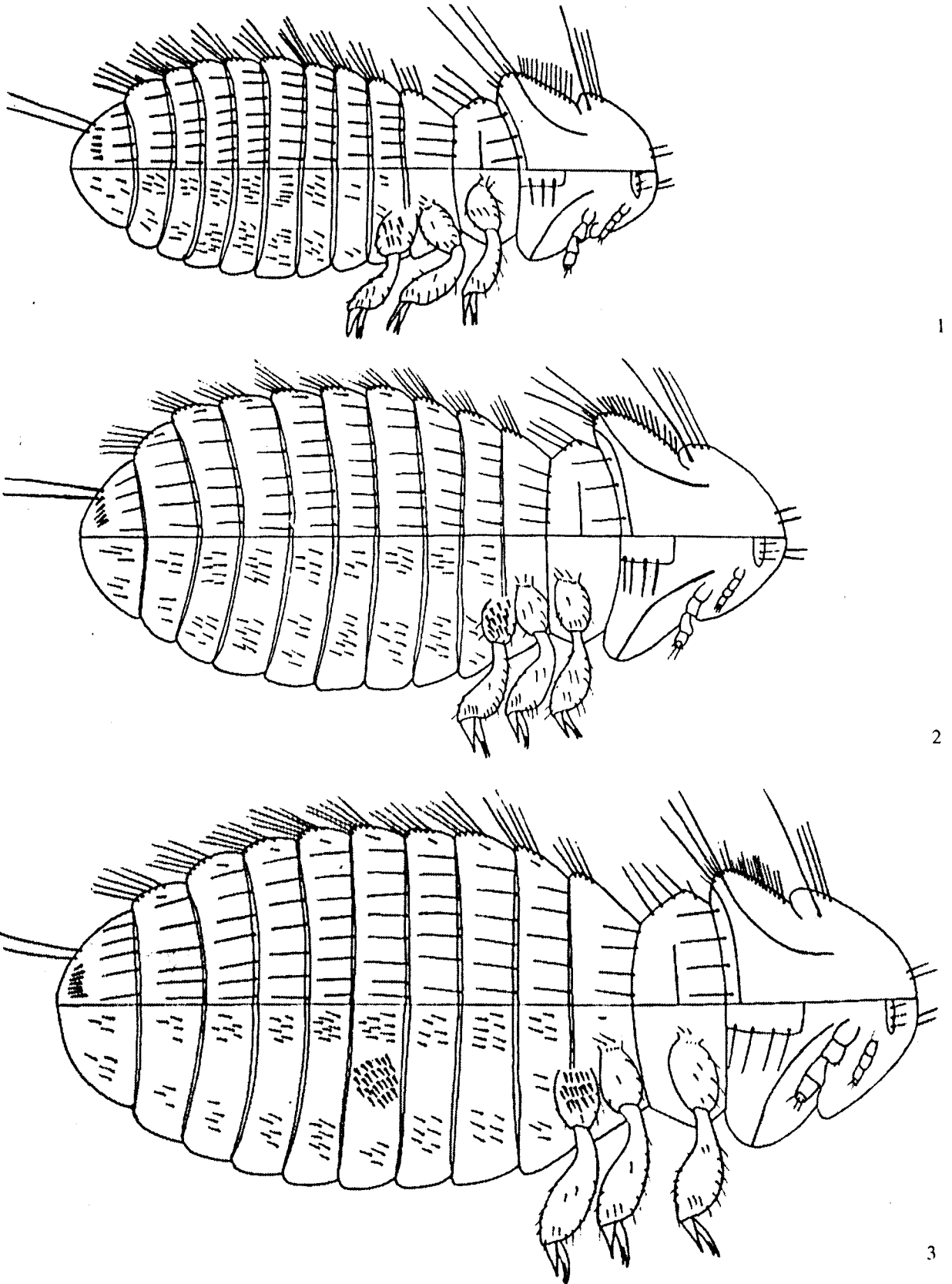
Observation

First instar nymph (Fig. 1): The body of first instar nymph is elongated in shape and creamy white in appearance. It measures 0.801 to 0.837 mm in length and 0.300 to 0.357 mm in width. The head is roughly triangular, more or less rounded anteriorly. Preantennal region is slightly narrower than postantennal and temporal region. Ocular emargination is distinct but shallow and preocular slit present. Temple is small rounded laterally furnished with three large and several small marginal setae. Occipital margin fairly concave bearing three submarginal setae on each half. Occipital blotch distinct. Mandibles feebly sclerotised, situated a short distance behind the anterior margin. Chitinous framework for support of mandibles also visible. Oesophageal sclerite and gland feebly sclerotised. Maxillary palp four segmented. Gular plate quadrate, bearing 3 to 4 setae on each side. Head chaetotaxy as follows: anterior marginal carina 2, labrum 3, marginal temporal 6 (3 long and 3 small), subocular 10-12 (comb), postocular 1 (long), anterior subocular 3 (long) and occipital 3 setae.

Antennae prominent (large as compared to head) projecting beyond antennal sinuses; four jointed; scape squat, second segment sub-pyriform, third segment narrow flattened anteriorly to accommodate terminal segment and fourth segment nearly cylindrical.

Prothorax broad in centre and tapering towards side; lateral angles acute each with 3 long setae; posterior margin convex with 3 long setae on each half; transverse longitudinal bars distinct. Mesothorax very narrow and fused with metathorax, which is broad and strongly divergent (diverging to laterally); lateral angles acute bearing 4 setae and posterior margin nearly straight bearing 5 setae on each side. Legs robust, concolorous with body; tibia longer than femora, well furnished with hair and venter of third femora with 6-8 setae (femoral brush).

Abdomen elongate, oval, widest at fourth segment; length of segment nearly equal; posterior margins: I-III more or less straight, IV-VI very slightly concave, VII-VIII straight and last segment more or less rounded. Tergocentral setae: I, 10; II, 12; III, 14; IV, 16; V, 14; VI, 12; VII, 10; VIII, 8 and terminal segment with 2 large terminal and 5 small subterminal setae on each half. Pleurite with 4 long and one small marginal setae in all segments. Sterna with many spiniform setae, located in median and lateral areas: I, 4; II, 4; III, 12;



Figures 1-3. Instars of nymphs of poultry shaft louse, *Menopon gallinae*. Fig. 1: first instar nymph; fig. 2: second instar nymph; fig. 3: third instar nymph.

IV, 14; V, 15; VI, 15; VII, 9; VIII, 9 and 6 on terminal segment; no brush on fourth sternite. Spiracular openings indistinct.

Second instar nymph (Fig. 2): Second instar nymph is also elongated in shape and slightly pale yellow in appearance (measuring 0.913 to 0.953 mm in length and 0.402 to 0.462 mm width). Head morphology more or less similar to first instar nymph (with respect to shape, nature of ocular emargination, ocular fringe, preocular slit, occipital margins, mandibles including chitinous frame-work for support, maxillary and labial palp, hypopharynx and gular plate). However, mandibles, chitinous frame-work and oesophageal sclerite exhibit better sclerotization. Nature of antennae also similar but antennal size similar to first instar. Head chaetotaxy as follows: anterior marginal carina 2, labrum 3, marginal temporal 6 (3 long and 3 small), subocular comb 12 to 14, postocular 1 (long), anterior subocular 3, occipital 3 and gular 4.

Nature of prothorax and metathorax similar to first instar nymph but slightly pigmented. Lateral angles acute with 3 setae and posterior margin convex with 4 setae. Lateral margin of metathorax bear 4 setae and posterior straight margin beset with 5 setae. Nature of legs similar to first instar, venter of third femora bears 12-13 small spiniform setae (femoral brush).

Abdomen elongate, elliptical, widest at fourth segment; abdominal segments unequal. Posterior margins of segments: I-III straight, IV-VII very slightly concave and VIII straight. Tergocentral setae: I, 12; II, 14; III, 16; IV, 16; V, 14; VI, 12, VII, 10; VIII, 8 and terminal segment with 2 large terminal and 5 small subterminal setae. Pleural margin beset with 5 large and one small setae in all abdominal segments. Sternal plates with small spiniform setae (distributed mainly in median and lateral areas): I, 9; II, 12; III, 13; IV, 12; V, 13; VI, 14; VII, 14; VIII, 7 and 6 on terminal segment. No brush on fourth abdominal segment, spiracular openings indistinct.

Third instar nymph (Fig. 3): Third instar nymphs are also elongated in appearance and appear pale yellow with pitchy brown markings on lateral margin of thorax and abdominal segments. The nymph appears darker than second, due to better sclerotization. It measures 1.497 to 1.541 mm and 0.602 to 0.635 mm in width.

Head morphology similar to N 1 and N 2 with respect to shape (and nature of ocular emargination, ocular fringe, preocular slit, occipital margin, mandible, chitinous frame-work, maxillary and labial palp, hypopharynx and gular plate). However, above said areas are better sclerotized. Size of antennae similar to first instar inspite of increasing size. Head chaetotaxy as follows: anterior marginal carina 2, labrum 3, marginal temporal 6 (3 long and 3 small), subocular comb 12 to 16, postocular 1 (long), anterior subocular 3, occipital 4 and gular 4.

Nature of prothorax and metathorax similar to second instar but more pigmented. Prothorax with 5 setae on lateral margins (4 long and 1 small) and 4 setae on posterior margin. Lateral angles of metathorax acute with 4 setae and posterior margin beset with 6 setae on each side. Nature of legs similar to second instar; venter of third femora with 14 to 18 small spiniform setae.

Abdomen elongate, elliptical, widest on third segment, posterior margin I-III straight, IV-VII slightly concave and VIII straight. Tergocentral setae: I, 12; II, 14; III, 16; IV, 16; V, 14; VI, 14; VII, 12; VIII, 10 and terminal segment beset with 2 large terminal and 7 small subterminal spine. Pleural margin bear 5 large and 1 small setae in all abdominal segments. Sternal plates with small spiniform setae (scattered mainly on median and lateral areas): I, 10; II, 14; III, 13; IV, 13; V, 15; VI, 11; VII, 10; VIII, 7, and 7 on terminal segment. Sternum of fourth abdominal segment bears a brush of 21-26 small spiniform setae. Spiracular openings slightly visible.

The ratio of length of head, thorax and abdomen in three nymphal instars remained 1 : 0.53 : 2.38 in N 1, 1 : 0.62 : 2.55 in N 2 and 1 : 0.63 : 4.06 in N 3, indicating increased abdominal length in third instar nymph. The adult can be easily differentiated from the nymph on the basis of presence of better sclerotization, pigmentation, large lip-shaped stigmata from abdominal segments II-VIII and genitalia/genital apparatus in the posterior abdominal segments.

Discussion

It has been noted by the workers that three nymphal instars of phthirapterans differ in length of body, dimension of body parts and also the size of head (CLAY 1958; CONCI 1952, 1956 a, b; EICHLER 1948, 1963; v. KÉLER 1952; KESSEL 1942; MARTIN 1934; MEY 1994; MODRZEJEWSKA & ZŁOTORYCKA 1987). Nymphs of more specialized groups can be characterized by peculiar modification of setae (gradual modification in adults). For example, in *Eulaemobothrion cubense*, in successive instars, number of setae transformed into thick thorns on osculum (successively grow to create definite sets in adults) (EICHLER 1963). In some representatives of Ischnocera (e. g. *Columbicola columbae*) clypeal setae develop only in N 3. Gradual appearance of new setae and darkened sclerites in nymphs had been noted by many of above listed workers and making diagnosis of individual nymphal instars through progression of chaetotaxy has been recommended by CLAY (1958), EICHLER (1963) and MEY (1994).

In case of *Menopon gallinae* N 3 can be differentiated from N 1 and N 2 due to appearance of brush on 4th sternal plate, spiracular apertures and also on

the basis of better sclerotization, increased number of setae on subocular comb, pronotum, mesometanotum, 6-8 abdominal segments, terminal segment, and femoral brush. Likewise, N2 can be differentiated from N1 due to better sclerotization and increased number of setae on subocular comb, pronotum, gular plate, first to third abdominal segment and the femoral brush. On the other hand, presence of lip-shaped stigmata (on abdominal segment, II to VIII), genitalia, complete sclerotization as well as pigmentation make the adults distinct from nymph.

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Summary

Nymphs of successive generation of *Menopon gallinae* (L., 1758), parasite on *Gallus gallus* f. *domestica*, highly resemble to each other from the moment of emergence and show the number of abdominal segments characteristic of adult form. Apart from evident differences in body size, the relative size of abdomen (head, thorax and abdomen ratio), rising chitinization of cuticle, the successive nymph stages can also be distinguished on the basis of progression of chaetotaxy. Furthermore, brush (spiniform setae) on fourth sterna and spiracular aperture become evident in third instars nymphs.

Zusammenfassung

Beschreibung der Larvenstadien des Schaftläuslings vom Haushuhn Menopon gallinae (Insecta, Phthiraptera, Amblycera, Menoponidae). - Alle drei Larvenstadien von *Menopon gallinae* (L., 1758) werden morphologisch beschrieben. Sie sind sich habituell sehr ähnlich und weisen dieselbe Abdominalmetamerie wie die Imagines auf. Außer proportionalen Unterschieden in den Körpermaßen (Kopf, Thorax und Abdomen) und zunehmender Chitinisierung lassen sie sich auch anhand der Chaetotaxie deutlich voneinander trennen. Der laterale Borstenfleck auf dem 5. Abdominalsternit sowie die Spiracularstrukturen erscheinen erst bei der Drittlarve.

Literature

- AGARWAL, G. P. (1967): Studies on the bionomics and life-history of *Falcolipeurus frater* (Giebel: 1874) (Mallophaga: Ischnocera). - *Indian J. Zootomy* **3**, 21-40.
- ARORA, G. L. & N. P. CHOPRA (1959): Observations on the life-history of *Lipeurus tropicalis* Peters (Mallophaga: Ischnocera). - *Res. Bull. Panjab Univ. Sci. (N. S.)* **10** (11), 179-187.
- CLAY, Th. (1958): Revisions of Mallophaga genera. *Degeeriella* from the Falconiformes. - *Bull. Brit. Mus. (Nat. Hist.) Entomol. (London)* **7**, 123-207.
- CONCI, C. (1952): L' allevamento in condizioni sperimentali dei Mallofagi I. *Cuclotogaster heterographus* Nitzsch. - *Boll. Mus. Ist. Biol. Univ. Genova* **24**, 17-40.
- (1956 a): L' allevamento in condizione sperimentali dei Mallofagi II. - *Stenocrotaphus gigas* (Taschenberg). - *Mem. Soc. entomol. Ital.* **35**, 133-150.
- (1956 b): L' allevamento in condizione sperimentali dei Mallofagi III. - *Columbicola c. columbae* (Linnaeus, 1758). - *Boll. Mus. Ist. Biol. Univ. Genova* **26**, 47-70.
- CRYSTAL, M. M. (1949): A descriptive of the life history stages of the dog biting louse, *Trichodectes canis* (DeGeer) (Mallophaga: Trichodectidae). - *Bull. Brooklyn entomol. Soc. (Brooklyn)* **44**, 89-97.
- EICHLER, Wd. (1948): Schutzfärbung bei Federlingen. - *Vögel d. Heimat (Aarau)* **18**, 103-108.
- (1963): Mallophaga. - *Bronns Kl. Ord. Tierr., Fünfter Band, III. Abtlg. 7. Buch, b) Phthiraptera, I. Teil.* - Leipzig.
- KÉLER, St. v. (1952): Über die Wachstums-Progression bei *Pseudomenopon rowanae* Kéler. - *Beitr. Entomol. (Berlin)* **2**, 113-119.
- KISSI, E. (1942): Von Hautlingen und Federlingen. - *Mikrokosmos (Stuttgart)* **35**, 79-84.
- MARTIN, M. (1934): Life history and habits of the pigeon louse (*Columbicola columbae* [Linnaeus]). - *Canad. Entomol.* **66**, 6-16.
- MEY, E. (1994): Beziehungen zwischen Larvenmorphologie und Systematik der Adulti bei den Vogel-Ischnozeren (Insecta, Phthiraptera, Ischnocera). - *Mitt. Zool. Mus. Berlin* **70**, 3-84.
- MODRZEJEWSKA, M. & J. ZŁOTORZYCKA (1987): Studies on morphology of nymphs of selected Amblycera and Ischnocera (Mallophaga). - *Pol. Pismo Entomol.* **57**, 657-672.
- PIOTROWSKI, E. & S. KADULSKI (1970): *Cervicola meyeri* (Tasch.) (Mallophaga, Bovicolidae) from the roe deer. - *Acta parasitol. pol.* **18**, 305-314.
- WILSON, F. H. (1939): The life-cycle and bionomics of *Lipeurus caponis* (Linn.). - *Ann. Entomol. Soc. Am.* **32**, 318-320.
- ZŁOTORZYCKA, J. (1990): Ultrastruktura powierzchni głowy wybranych Bovicolidae (Mallophaga, Ischnocera). - *Wiad. Parazytol.* **36**, 39-45.

- & M. MODRZEJEWSKA (1992): Cechy morfologiczne ze szczególnym uwzględnieniem ultrastruktury powierzchniowych u *Docophoroides brevis* (Docophoroididae, Mallophaga). - Wiad. Parazytol. **38**, 43-50.
- , - & A. K. SAXENA (1995): *Heterodoxus spiniger* (Bopopiidae, Mallophaga) from *Canis familiaris* from India in the light and scanning electron microscope. - Wiad. Parazytol. **41**, 455-462.

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