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ROLE OF ASYMMETRY IN THE SPECIATION OF CERTAIN LICE (PHTHIRAPTERA : INSECTA)

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ABSTRACT

It has been recognized that asymmetry plays a considerable part in animal speciation, particularly in insects. This aspect has been examined in certain "Chewing-lice" infesting birds. Two kinds of asymmetry is noticed, one affecting the body parts other than genitalia, and the other only genitalia. While the former is due to the ecological adaptations, the latter occurs during the sympatric speciation. Occasionally asymetric forms also appear due to accidental damage, as in certain individuals hurt during preening, but recovered from the injury.

INTRODUCTION

Though insects also exhibit the bilateral symmetry as in many other Metazoa, occassionally we come across cases of asymmetry either in one or both the sexes. In the chewing-lice (Mallophaga *sens. lat.*) this phenomenon seems to be more common than so far appreciated.

Harrison (1914) was the first to draw our attention to the asymmetry of the head structure in the lice parasitic on ostrich, rheas, nandu, and emu. Cummings (1916) proposed the genus *Struthioliperus,* for some of the lice parasitic on ostrich, rhea and nandu, suggesting that possibly two other species parasitic on rheas and nandu, and also the one on emu belong to distinct genera, but all of them, however, closely related. Keler (1936) established the genus *Dahlemhornia* for species on emu, and Eichler (1940) erected the genus *Meinertzhageniella* for rest of the species parasitic on rhea and nandu. Paine (1917) referred to the symmetry of the head in *Philopterus ambiguus* Giebel (now *Bizarrifrons magus* (Nitzsch) (parasitic on Icteridae for the first time, and Eichler (1938) established the genus *Bizarrifrons* for it and other species parasitic on Icteridae with similar heads. Clay (1950) stated that the asymmetry might have originated more than once in bird infesting lice. Eichler (1936) stated that the asymmetry in mandibles and the front of the head is common amongst the Ischnocerophthirina, probably correlated with the feeding habits, the feather structure of the host, and that such asymmetry is also met with in Psocoptera, from which the lice are believed to have descended. While head asymmetry in *Struthiolipeurus* is due to the feeding habits (Lakshminarayana, 1973), the asymmetry phenomenon is perhaps more predominant in Amblycercphthirina than in Ischnocerophthirina. Lakshminarayana and Emerson (1971) recognized the species of

Goniocotes parviceps (Piaget) and its counterpart *G. mayuri* Lakshminarayana and Emerson in the sympatric pair, which evaded the notice of systematists for well over a hundred years, chiefly by the asymmetry in the male genitalia in the former. Price (1966 a) redefined the *Eomenopon* parasitic on Psittaciformes as having asymmetrical genitalia in all the members included in this genus ; this condition is also exhibited in another closely related genus *Pacifimenopon* (Price, 1966 b). Price (1967) described a new subgenus *Cacamenopon* in the genus *Franciscoloa* Conci (also parasitic on Psittaciformes), where the male genitalia and the sternites VI-VII also exhibit the asymmetry. The genus *Trinoton* Nitzsch is very well known, but none has pointed to the asymmetry of its male genitalia. The present paper aims to draw the attention of phthirapterologists, that the development of asymmetry is not a passive phenomenon amongst the bird infesting lice, but seems to be more frequent than hitherto recognized ; perhaps of considerable significance in the speciation and therefore, can conveniently be used for specific and even generic diagnosis.

The asymmetry in the lice can be grouped under the following heads :—

ECOMORPHIC ASYMMETRY

The head and body structure of the avian infesting lice is largely influenced by the occupational niche, *viz.*, round and stout bodied forms with circumfasciate heads generally occupy the head and neck niches (where they are not exposed for preening), while the slender forms, often with specialized heads are found in the wing and abdominal regions of the host (thus escape the preening) (Clay, 1949, 1950 ; Lakshminarayana, 1977). Lakshminarayana (1973) suggested that the asymmetry of the head of *Struthiolipeurus* (Fig. 1A) must have been primarily derived from an ancestor with a symmetrical head and incrassations as in the genus *Falcolipeurus* Bedford (Fig. 1B) consequent to a secondary infestation on ostrich, rheas, and nandu. The feather structure of the new hosts must have exerted considerable stress on the mandibular musculature during feeding, and the differential pull on either side might have altered the mandibular framework leading to the asymmetry of the head. Perhaps, the same factors might have been responsible for the head a symmetry in *Dahlemhornia* (Fig. 1C) and *Meinertzhageniella* also. Though, Cummings (1916) believed that the asymmetrical condition develops at later instars, it was noticed even in earlier instars in *S. stresemanni* Kéler (Lakshminarayana, 1973). The reason for the head asymmetry in *Bizarrifrons* (Fig. 1D) is not clearly understood at the time. In *Ornithopeplechthos opisthocomi* (Cummings) only the male shows the mandibular asymmetry, while the mandibles are normal in the female(Figs. 1E & F) and is useful in generic diagnosis with in the *Laemobothrion*-complex (Lakshminarayana, 1970). Since the asymmetry is confined to only one sex, it is not certainly correlated to feeding or feather structure of the host, but may be connected to the sex, and the functional significance is worth investigating.

ASYMMETRY DUE TO PHYSIOLOGICAL CAUSES

The variation in number and size of certain setae associated near the genital region, especially in the females of *Goniodes*-complex may be due to some physiological disturbance in the sexes. In *Myrsidea* the sternite II always carries an aster of setae on either side from a prominent of reduced tubercle (Fig. 1G). The length and number of the setae are variable between the species, sexes, and even on the two sides ; this variation has been used in specific and even generic diagnosis. The functional significance of these tubercles and setae is not known and probably chemoreceptive. Basing generic

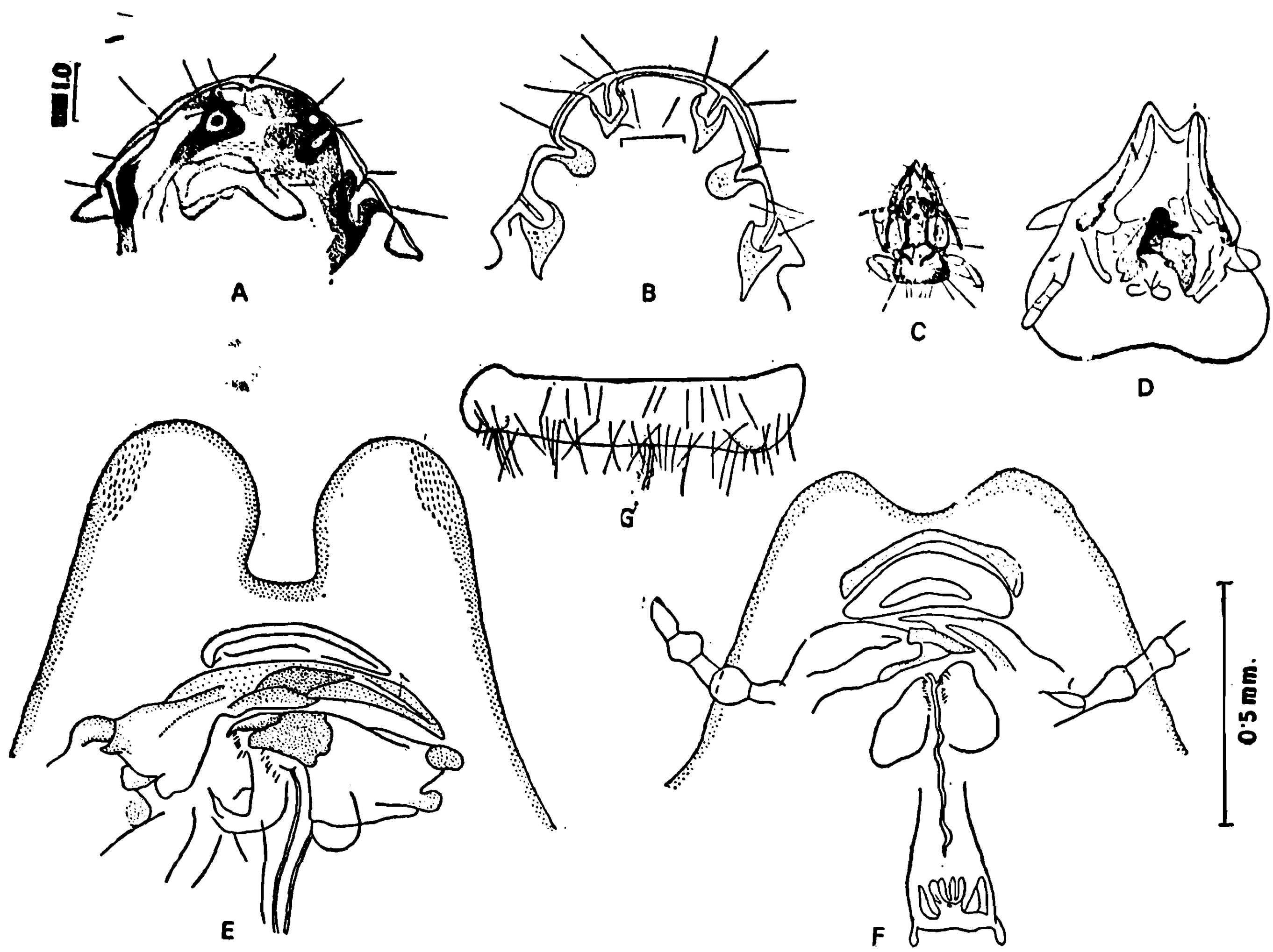


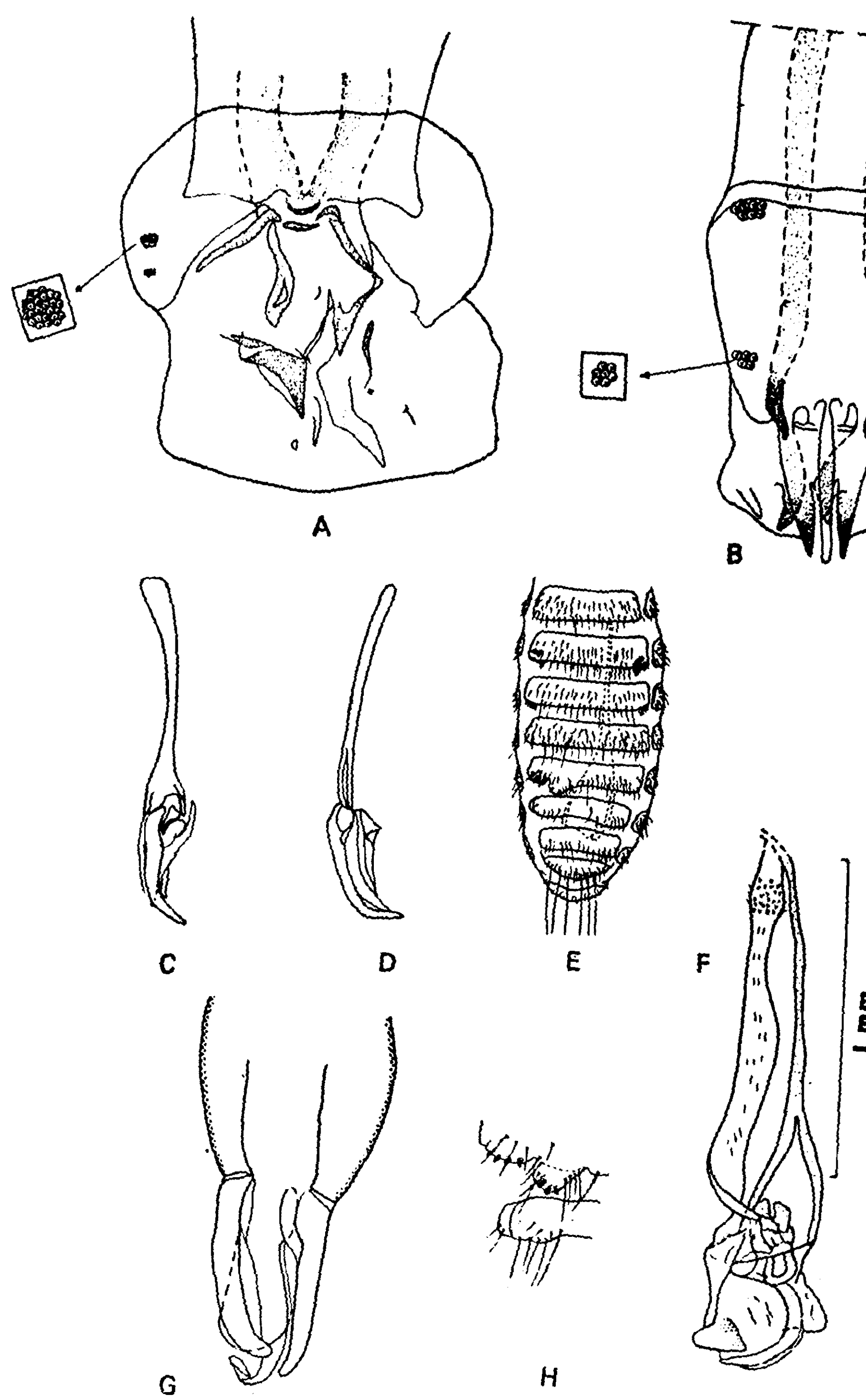
Fig. 1. (A-F) Heads of : A—*Struthiolipeurus stresemanni* ; B—*Falcolipeurus quadripustulatus* ; C—*Dahlemhornia asymmetrica* ; D—*Bizarrifrons* ; E—*Ornithopeplechthos opisthocomi, male* ; F—*O. opisthocomi* female ; G—II sternite of *Myrsidea cornicis* ;

diagnosis on their nature and number alone may lead to erroneous conclusions.

Asymmetry in the Genitalia as Isolating Mechanism in Breeding

Goniocotes parviceps (*vide* supra) with asymmetrical genitalia can easily be derived from its counter part in the sympatric pair, *G. mayuri* with asymmetrical male genitalia (Fig. 2A & B). Both evolved on the two closely related host species, viz., *Pavo cristatus* Linne, and *P. muticus* Linne. It is assumed that some of the original *mayuri* populations on the *cristatus* host might have been passed on to the *muticus* host, when the latter evolved (probably from *cristatus*) in thick forest belt of Assam-Burma axis and the island chain, and got isolated from the parent *mayuri* populations on *cristatus* for some time. When the two host populations were united later due to altered geographical conditions, their respective louse populations also had perhaps chance meeting. The cross breeding between the two populations might have been prevented owing to the development of asymmetrical male genitalia in one of them, thus leading to the speciation of *parviceps* (cf. Lakshminarayana and Emerson, 1978). The females of both the species are identical and seperable only with considerable difficulty.

The genera *Eomenopon*, *Pacifimenopon* and *Trinoton* (Fig. 2C, D & F) also might have evolved from ancestors with symmetrical male genitalia in the bygone, but the number of species with asymmetrical genitalia included under the genera are considerable, and therefore, the species with asymmetrical genitalia seem to be quite successful over the species with symmetrical genitalia. The



Fig, 2. (A-G) Male genitalia : A—*Goniocotes parviceps* ; B—*G, mayuri* ; C—*Eomenopon sintillatae* ; D—*Facifimenopon fuscatae* ; E—*Franciscoloa* (*Cacamenopon*) *hodsoni* ; F—*Trinoton querqulac* ; G—*Dahlemhornia asymmetrica* ; H—Sternites VI-VIII *of F.* (*C*) *hodsoni*.
(Figs. 2C, D, E, H *After* Price)

extreme development of asymmetry of not only in the male genitalia, but also of sternites VI-VII in the subgenus *Cacamenopon* (Fig. 2E & H) also suggestive that asymmetry is playing an important role in the evolution. Eichler (1963) figured the asymmetry of male genitalia in *Halipeurus mirabilis* Thompson (1940). *Dahlemhornia asymmetrica* in addition to the asymmetry of the head, also shows asymmetry in male genitalia (Fig. 2G) which was hitherto escaped notice. This fact further confirms that this species might not only have secondarily infested a new host and developed asymmetry, but also the back cross with its ancestral form must have been prevented by its asymmetrical male genitalia.

TERATOLOGICAL ASYMMETRY

The host while preening might injure few of the early instars, which some how escape and survive. The healed wound occassionally persists in later instars, thus giving an abnormal appearance often referred to as a freek. Blagovashtchensky (1950) figured the abnormalities in *Brueelia* and Eichler (1963) the teratological asymmetry of the posterior part of *Strongylocotes complanatus* (Piaget). The teratological asymmetry has no significance in the speciation problem.

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