Proc. Symp. zool. Surv. India, No. 1 : 41-46, 1979

INTRA-SPECIFIC VARIATIONS IN INSECTS WITH SPECIAL REFERENCE TO THE CHEWING-LICE (PHTHIRAPTERA)

K.V. LAKSHMINARAYANA

Zoological Survey of India, Calcutta

The variation in biological communities leads to speciation, and there by evolution, which is the spice of life. No two individuals in Nature are alike, since every organism reacts in its own way to the abiotic and biotic fluctuations in the environment that surrounds it, which is responsible for the inter-and intra-specific variations. These variations may be temporary or permanent when they are inherited in a true Mendelian fashion. The temporary variatons on the other hand are transient such as the teratological variations which do not occur time and again in the species as a whole. The permanent variations, whatever may be the causative factor, such as the environmental effects, hormonal physiology, etc., must be followed by a genetical change or *vice versa* for those variations to appear again and again in a population or species.

Generally the variations are measurable qualitatively or quantitatively. Mayr (1969) grouped the intra-specific variations into I. Non-genetic variaation, and II. Genetic variation. According to this author, the former category includes the following : Individual variation in time (due to age, individual variation due to the season, and cyclic variations in the generations), Social variation (insect castes), Ecological variation (due to habitat climate, host determined, population density, allometric, and neurogenic colour variation) and lastly the Traumatic variation (due to parasitic effect and teratological variations). The Genetic variations are sex associated (due to primary or secondary differences in the sexes, alternation of generations, gynandromorphs or intersexes) and non-sex associated (which may be continuous or discontinuous, or genetic polymorphism.)

Of these factors, for taxonomic purposes in Phthiraptera we normally consider the following characters : size, structure, colour, host or climate induced factors.

SIZE

The chewing-lice are obligatory ectoparasitic insects on birds and mammals, and the size is the most common variation amongst them. The females are generally larger than males, although certain individual organs like the antenna may be larger than the counterpart in the female as in *Goniodes,* *Lipeurus*, *Oxylipeurus*, etc., especially in the suborder Ischnocerophthirina. The populations found in tropical climate tend to be smaller than the corresponding ones in the temperate regions like Poland; thus these populations are following the traditional Bergmann's law that larger individuals are found in the cooler climates (Clay, 1949; Lakshminarayana, 1977). In fact, it is the host species which follows this principle to a greater degree in terms of growth and health, and the larger the birds are, the lower their body temperatures as compared to the individuals of the same species inhabiting hotter climates. The lice on the larger birds, with lower body temperatures (also perhaps with better health), find the host more conducive for development, and therefore, grow to a larger size than those found on smaller individuals with higher temperature, in the hotter climates. When the host is sickly as in domestic fowl and heavily infested by one or more species of lice, the latter tend to be smaller. Teneral forms are also slightly smaller than the mature adults. One should carefully weigh the size variation in the taxonomy of this group, and at best it serves as a supplementary character.

STRUCTURE

For any taxonomist, the morphology of the specimen before is the most important attribute. At times, we find some asymmetrical or abnormal individuals in the populations of the lice. These abnormalities may be temporary and restricted to a particular instar, or may be found in all the instars. They are the results of healing of mechanical injuries caused by the host preening operations. The teratological asymmetry has been discussed elsewhere (Lakshminarayna, in press)

The chewing-lice are clothed with setae and the variation in the number and size has been given very heavy weightage in the past. It is known that certain setae are often present or associated with certain structures constantly and are very important either subspecifically, specifically and even generically also. To quote a few, the head setae in Amblycerophthirina (Clay 1962, 1966, 1969, 1970); and *Laemobothrion*-complex (Amblycerophthirina the modified head setae in *Anatoecus, Columbicola, Anaticola* (Ischnocerophthirina) the setae on the antennal segment in the male *Goniodes-Goniocotes* complex; the tubercular setae on sternite II in *Myrsidea* the post-spiracular setae; and the tuberculate setae on the ventrolateral edge of the IX and the setae and spines on the female genital region in *Goniodes*, segment in *Rallicola*-complex, may be cited. But there are other setae which vary from not only individual to individual but also from segment to segment, and on the right and left sides. These variations are very trivial and should not be banked in distinguishing the species from a population when other morphological characters are common to all of them.

Certain structural characters like presence or absence of maxillar palpi, number of antennal segments, nature of mandibles, position and shape of the spiracles, presence of gonapophyses, presence of ctenidia pr comb rows, are either subordinal, family, generic, specific, and even subspecific importance. The presence of a U-shaped structure and holes on the sitophore sclerite are useful characters for identification of different populations at a glance (Nelson & price, 1965, Lakshminarayana, 1968,1970), the shape of gular plate in *Pseudomenopon* (clay, 1969 ; Price, 1974) is also an important character. Variation on the head outline, and the number and nature of setae on II abdominal sternite in *Degeeriells* and *Myrsidea* respectively have been given over emphasis in distinguishing species from different populations of the same species. The structure of male genitalia is however, will be very helpful in distinguishing species from populations of sympatric species.

COLOUR

The insect colouration may be structural, or pigmental origin or a combination of both, and follow the VIBGYOR principle in colour production. The structural colouration is due to the arrangement of scales, fluting or grating of the cuticle. The metallic colouration is due to diffraction, interference, or Tyndall effect (as in the blues of Odonates), or selective reflection. The pigment colouration is due to the presence of B-Carotenoids, astaxanthin, insectorubin, insectoviridin, melanin, flavones, and occassionally by the dissolved haemoglobin as in Chironomid larvae. The structural colouration is essentially a genetic factor, while the pigment colouration may be gene controlled and the resultant production of aminoacids and proteins, or influenced by the climate, crowding, or other physiological causes. In Phthiraptera the colour variation is not of much importance being light to dark brown and black, although certain blotches, spots, and bands are occasionally of important nature in distinguishing populations and species. Members of *Myrsidea* parasitic on Icteridae often show brilliant colouration, due to reflection of the semi-digested iridescentf eathers of the host.

SEX-ASSOCIATED VARIATIONS

Certain variations are associated with sex, for example, the Gonapophyses of the Trichodectid female, male antenna of *Goniodes*, *Lipeurus*, *Oxylipeurus-Complex*, mandible in the female *Ornithopeplechthos* (Lakshminarayana, 1970, Lakshminarayana, 1979), or the setæ and pockets found on abdominal female segment of *Cavifera* (Price & Clay, 1970). when such variants occur in a species, a taxonomist may name them separately if only a single sex is available for his study; it is not desirable to describe the species on the basis of one sex alone, except when that genus/ or species exhibit diagnostic characters more either in the male or female. More often, we encounter more than one species belonging to different genera or populations of sympatric species on a given host, therefore, one should be very careful while describing a species basing on one sex alone.

Host or Climate Induced Variations

Populations found on host species in different ecological zones are likely to vary. Intra-specific variations can be fixed by studying a series of populations from different geographical ranges, or by breeding experiments. The biology of very few species have been studied and because of the obligatory nature of the chewing-lice, in the absence of *vitro* techniques in rearing, it is difficult to study the biology of many species found specially on the wild hosts. Generally, the females outnumber males, and in few instances the males are extremely rare and the females are believed to be parthenogenic (Hopkins, 1949). We know amongst insects, that individuals undergoing diapause and those of non-diapausing broods not only show variation in the structure, colour, etc., but also in the colour of the eggs (for ex., *Bombyx mori*) and their respective hatching intervals also differ. We are not aware whether any populations of chewing-lice undergo diapause or not, but it may be expected in populations occurring on the migratory host species; likewise, the effect of photo-period is not known. Since the chewing-lice inhabit the feather or hair cover, their microclimatic variations may be negligible as compared to the environmental fluctuations to which their hosts are subjected. But those species that inhabit the head region of the birds are liable to be exposed to more heat and light because of the sparse feathers in this region, and certainly some influence of climatic heat or photoperiod effect may be there on these forms.

Acknowledgement

The author is grateful to the Director, Z. S. I., for all the facilities and encouragement.

References

Clay, T. 1949. Some problems in the evolution of a group of ectoparasites.- *Evolution,* 3(4) : 279-99.

Clay, T. 1962. A key to the species of *Actornithophilus* Ferris with notes and descriptions of new species.—*Bull. Br. Mus. (nat. Hist.) Ent.*, **11** (5) : 189-244.

CLAY, T. 1966. Contributions towards a revision of *Myrsidea* Waterston I. (Menoponidae : Mallophaga).—*Bull. Br. Mus. (nat. Hist.) Ent.*, **17** (8) : 329-395.

CLAY, T. 1969. A key to the genera of the Menoponidae (Amblycera : Mallophaga : Insecta).—*Bull. Br. Mus. (nat. Hist.) Ent.*, **24** (1) : 1-26.

CLAY, T. 1970. The Amblycera (Phthiraptera : Insecta).—*Bull. Br. Mus. (nat. Hist.) Ent.*, **25** (3) : 73-98.

CLAY, T. AND PRICE, R. D. 1970. A new genus and two new species of Menoponidae (Insecta : Mallophaga) from New Guinea.—*Zool. J. Linn. Soc.*, **49** (4) : 335-343.

HOPKINS, G. H. E. 1949. The host association of the lice of mammals. —*Proc. zool. Soc. Lond.*, **119** : 387-604.

LAKSHMINARAYANA, K. V. 1967. Mallophaga Indica I. On the status of *Eulaemobothrion* Ewing, with description of a new species from India. *Oriental Ins.*, **1** (3-4) : 257-264.

LAKSHMINARAYANA, K. V. 1970. Mallophaga Indica IV. Trends in evolution in the *Laemobothrion*-complex (Phthiraptera : Mallophaga) with description of a new genus.—*Oriental Ins.*, **4** (2) 131-142.

LAKSHMINARAYANA, K. V. 1977. Factors involved in the host specificity in Mallophaga sens. lat. (Phthiraptera : Insecta) infesting birds.—*In* T. N. Ananthakrishnan ed. *Insects and host specificity.* (The MacMillan Co. of India Ltd., Delhi) : 101-109.

LAKSHMINARAYANA, K. V. 1979. Role of asymmety in the speciation of certain-lice (Phthiraptera : Insecta).—*Bull. Zool. Surv. India.* **2** (i) : 29-34.

MAYR, E. 1969. *Principles of Systematic Zoology.*—(Tata McGraw-Hill Publ. co. Ltd.) Bombay & New Delhi : xi+428 pp., 112 figs.

NELSON, R. C. AND PRICE, R. D. 1965. The *Laemobothrion* (Mallophaga : Laemobothriidae) of the Falconiformes.—*J. Med. Ent.*, **2** (3) : 249-257.

PRICE, R. D. 1974. A Review of the genus *Pseudomenopon* (Mallophaga : Menoponidae).—*Ann. ent. Soc. Am.*, **67** (1) : 73-84.