

THE LOUSE OF ELEPHANTS.

HAEMATOMYZUS ELEPHANTIS PIAGET (MALLOPHAGA:
HAEMATOMYZIDAE).

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(From the Molteno Institute for Research in Parasitology,
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(With Plates IV and V and 5 Text-figures.)

It is now slightly more than 60 years since Piaget described as *Haematomyzus elephantis* an extraordinary insect found by him living as an ectoparasite upon an African elephant in the Zoological Garden of Rotterdam. The insect was considered by its describer to be a sucking louse, and this assignment has been accepted by almost all of the few entomologists who have since been privileged to examine specimens. Walker, who in ignorance of Piaget's work, redescribed the species as *Idolocoris elephantis*, regarded it as constituting a new family of Hemiptera Heteroptera near the bed bugs. Since that time no one has questioned the belief that it is a sucking louse and for it Enderlein named a family, the Haematomyzidae, in the Anoplura.

The Molteno Institute for Research in Parasitology has acquired from various sources a considerable number of specimens of this insect. Through the kindness of Prof. G. H. F. Nuttall, the present writer has been permitted to study this material, which has been supplemented by other specimens received as loans through the kindness of the authorities of the British Museum and the Hamburg Museum. Although the condition of the specimens is not favourable for any study of internal anatomy, and the time available to the writer has not in any case been sufficient for such a study, it is possible to present a fairly full analysis of the external morphology of the species, together with some fragmentary information as to immature stages.

It is clear, from this study, that *H. elephantis* is not a sucking louse.

SYSTEMATIC HISTORY OF THE GENUS AND SPECIES.

There being but one species in the genus, the generic and specific references for the most part coincide. They are therefore considered together.

1869. *Haematomyzus elephantis* Piaget, *Tijdschr. voor Entomol.* 12, 254.

The original description of the genus and species.

1871. *Idolocoris elephantis* Walker, Richter, *Hardwicke's Science Gossip*, pp. 131-132, fig. 67.

Richter quotes the description, prepared for him by Walker and therefore to be credited solely to the latter, of *Idolocoris elephantis*, new genus and species. The describer was ignorant of Piaget's earlier description. The statement is made that the genus forms the type of a new family of Hemiptera Heteroptera, although the family is not formally named. The description of the species is really good.

1871. *The Elephant Parasite*, T. G. Denny, *ibid.* p. 185.

Records merely that his father, author of the *Monographia Anoplurorum Britanniae*, possessed specimens of this species.

1871. *Idolocoris elephantis* Walker, Richter, *ibid.* p. 211.

Irrelevant discussion of the credit for the discovery of the new genus and species.

1871. *Phantasmocoris*, F. Buchanan White, *ibid.* p. 234.

Notes that *Idolocoris* Walker is a homonym of *Idolocoris* Douglas and Scott and proposes a new generic name.

1871. *Haematomyzus elephantis* Piaget, Günther, *ibid.* p. 278.

Re-establishes the name *Haematomyzus elephantis* Piaget.

1872. *Haematomyzus elephantis* Piaget, Newman, *Entomologist*, 6, pp. 465-470, fig.

Reproduces the figure of Richter, accompanied by much irrelevant discussion.

1880. *Haematomyzus proboscideus* Piaget, *Les Pédiculines*, pp. 658-660, pl. LIV, figs. 2-2 h.

For no apparent reason renames the species.

1897. *Haematomyzus proboscideus* Piaget, Mégnin, *Bull. Mus. d'Hist. Nat.* Paris, No. 5, pp. 167-169, figs.

Adds nothing to the knowledge of the insect.

1904. *Haematomyzus proboscideus* Piaget, Enderlein, *Zool. Anzeiger*, 28, pp. 136-137.

Names the family Haematomyzidae of the order Anoplura for this species.

1908. *Haematomyzus elephantis* Piaget, Dalla Torre, *Anoplura in Wytsman's Genera Insectorum*, p. 19, fig. 13.

Listed in catalogue, accompanied by crude figure.

1908. *Haematomyzus paradoxus* Lahille.

Unable to trace the reference.

1910. *Haematomyzus proboscideus* Piaget, Mjöberg, *Ark. för Zool.* 6, pp. 181-183, fig. 93.

Records the species and gives a largely inaccurate figure of the tracheal system.

1910. *Haematomyzus elephantis* var. *sumatranus* Fahrenholz, *Zool. Anzeiger*, 35, p. 714.

Preliminary diagnosis of a supposed new sub-species.

1910. *Haematomyzus elephantis* var. *sumatranus* Fahrenholz, *Jahresb. des Niedersächs. zool. Ver. zu Hannover* 58-59, Abt. D, p. 67.

Repetition of the preceding description.

1916. *Haematomyzus elephantis* Piaget, Ferris, *Proc. California Acad. Sci.* (Series 4), 6, p. 185.

Lists in catalogue.

1916. *Haematomyzus elephantis* Piaget, Fahrenholz, *Jahrb. d. Hamburg. Wiss. Anstalten*, 34, Beiheft 2, p. 6.

Records the two supposed sub-species from material in the Hamburg Museum.

1919. *Haematomyzidae*, Nuttall, *Parasitology*, 11, p. 333.

Notes that the mouth-parts are aberrant and require to be studied to render the systematic position of the family secure.

PREVIOUS RECORDS.

Recorded by Piaget from African elephant in the Zoological Garden of Rotterdam. By Richter from a single specimen from elephant in Ceylon. By Denny from specimens from unspecified kind of elephant in a travelling menagerie. By Megnin from unspecified elephant species from the Zoological Garden of Paris. By Mjöberg from Indian elephant, without indication of locality, from specimens in the Hamburg Museum. By Fahrenholz from specimens in the Hamburg Museum from Indian elephant in the Zoological Garden of Hamburg and from Sumatran elephant.

SPECIMENS EXAMINED.

A. Six slides from the Piaget collection, received on loan through the kindness of Major E. E. Austen of the British Museum which now owns this collection. These slides were remounted by me in order to render them suitable for study. The data concerning them are as follows:

One slide, containing a male and a female, labelled "*Haematomyzus proboscideus* P. sur un jeune éléphant d'Afrique." These may be regarded as the types of the species:

One slide, labelled by the same specific name and with merely the data, "sur une éléphant jeune." Probably co-type material.

One slide with the same specific name and with merely the data, "sur un Elephas."

Three slides, labelled by the same specific name, each containing two females and one male and each with the data "sur un éléphant de Sumatra." Apparently these were not in the hands of Piaget at the times when he recorded the species and are therefore not to be considered as type material.

B. Ten slides and four alcoholic specimens from the collection of the Hamburg Museum received on loan through the kindness of Dr E. Titschack, Director of that Museum. The data concerning these specimens being as follows:

This material includes on slides five females, four males and a mount of eggs, all bearing a label "Coll. A. Poppe (3. vii. 1901)" and variously "von Elephas sumatranus 1901" and "von Elephas indicus." It apparently does not include the types of Fahrenholz' *H. elephantis* var. *sumatranus*. The alcoholic material mounted by me includes one male, two females and an immature specimen. These are the specimens recorded by Fahrenholz (1916) as "von sumatranischen Elefanten, S. A. Poppe ded. 25. xii. 1901."

C. Numerous specimens, upon which the accompanying morphological studies have been based, in the Nuttall Collection of the Molteno Institute of Parasitology. These include three lots from Indian elephant, Rangoon, Burma "12. v. 1913. Dr H. H. Marshall," "12. vii. 1919. Dr H. H. Marshall," and "21. vii. 1919. Mr Rogers." One lot is indicated as from "*Rhinoceros indicus* (*unicornis*), Schönbrunn, Vienna Museum coll. 1885."

HOSTS.

Apparently all the specimens thus far taken of this species have been from animals in captivity. It is evidently normal to the Indian elephant, and whether the original record from African elephant, and above all, that from rhinoceros, indicate anything more than purely chance occurrences in zoological gardens remains to be determined.

SUPPOSED SUB-SPECIES.

I am unable to see any justification whatsoever for the supposed sub-species *sumatranus* named by Fahrenholz. It was based entirely upon slight differences in measurements.

MORPHOLOGY.

Size.

Total length of female, in expanded condition mounted on a slide, 3 mm. of which the head constitutes 1 mm. Male 2 mm., the head 0.75 mm. The specimens of the supposed variety *sumatranus*, which were indicated by

Fahrenheit to be smaller, are of approximately the same lengths when prepared in the same manner.

The head.

General form and structure. The form of the head recalls that of the rhynchophorous Coleoptera, the anterior portion being produced into a slender, down-curved beak. The fusion of the head sclerites has been carried so far that none of the individual plates can be detected, and it is only from the position of the eyes, the antennae and the mouth-parts that any deductions as to the homologies of parts can be made. The whole structure is heavily sclerotic, except for the ventral side of the head, which is slightly membranous. There are no epicranial or other sutures visible.

It is evident that the proboscis is formed by the elongation of all the parts of the head capsule lying anterior to the base of the antennae, the trophi and the oral opening being at the apex of this structure. The antennae arise from the sides of the head at the base of the proboscis.

The one-faceted eyes are in the position at the sides of the head which is normal to the compound eyes, of which they may be assumed to be vestiges, and there are no ocelli.

From the dorsal, posterior border of the head there arises a very large and conspicuous median apophysis, which projects into the thorax and is of a sharply conical form. It appears to be hollow and to open at the surface by a narrow slit. The occipital foramen is crowded to the apparent ventral side of the head and its anterior margin is marked by a pair of strongly sclerotic median lobes, between which a pair of apophyses, later to be described, are firmly attached.

The antennae.

The antennae (Fig. 3 C) are five-segmented and entirely simple in their structure. Their most striking feature is the length of the first segment, which is nearly as long as the next three segments together. The conspicuous thickenings of the walls, which are present in the antennae of all ectoparasitic forms, are strongly developed. The circular pits or sensoria, which are present on the two terminal segments of most, if not all, of the sucking lice, are here lacking.

The mouth-parts.

At the extreme apex of the proboscis there appear a number of heavily sclerotic and deeply pigmented teeth, some of which are dorsal, some ventral and some lateral. The entire structure which bears them is extremely small and the deep pigmentation renders it difficult, or even impossible, to see the more delicate, membranous connections. However, it is possible to dissect away the parts sufficiently well to reveal the fundamental features clearly.

The proboscis terminates dorsally in a flat plate (Fig. 2 B), which is rounded and slightly bilobed at the apex, with each of these lobes bearing a delicate, setiform structure. From the dorsal aspect of the plate there arise three pairs of flat, leaf-like teeth of which the first pair are close to the anterior margin, are small, irregularly lobed and lie in pits in the derm. The members of the

second pair are larger and are likewise contained within a depression. The members of the third pair are still larger and may even project somewhat beyond the sides of the proboscis.

The ventral termination (Fig. 2 A) consists of a pair of heavily sclerotic, elongate plates which are slightly separated medially by an ill-defined smaller plate. The lateral plates each bear posteriorly two flat, leaf-like teeth and culminate anteriorly in a rounded lobe (Fig. 2 D) that bears evidence of being composed of two segments each of which bears a single seta. This whole structure appears to be to some extent movable.

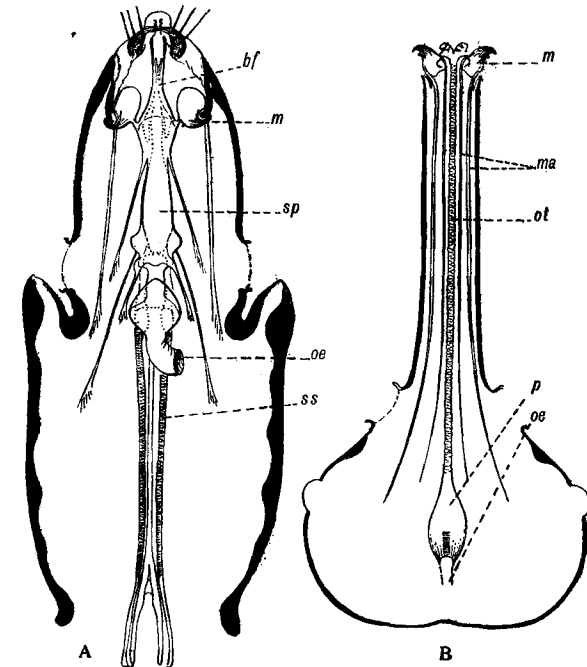


Fig. 1. A. Mouth-parts of *Haematopinus suis* (Linnaeus). B. Mouth-parts of *Haematomyzus elephantis* Piaget. *bf*, buccal funnel; *m*, mandible; *ma*, mandibular apodeme; *oe*, oesophagus; *ot*, oral tube; *p*, pharynx; *sp*, sucking pharynx; *ss*, stabber sac.

The sides of the proboscis, apically, are formed by a mass of small, curved teeth. Manipulation with a sharp needle demonstrates that those of each side are parts of a single, movable structure. This can be dissected off and viewed from the lateral aspect has the appearance shown in Fig. 2 C.

It is with these lateral structures that we are principally concerned. If they are carefully removed from the head, it can be seen that the structure of which they are a part bears a pair of apodemes that can be traced the full length of

the proboscis and into the cavity of the head. Furthermore, it can be demonstrated that the entire structure pivots upon a condyle which arises as a knob-like structure from the inner wall of the dorsal apical plate.

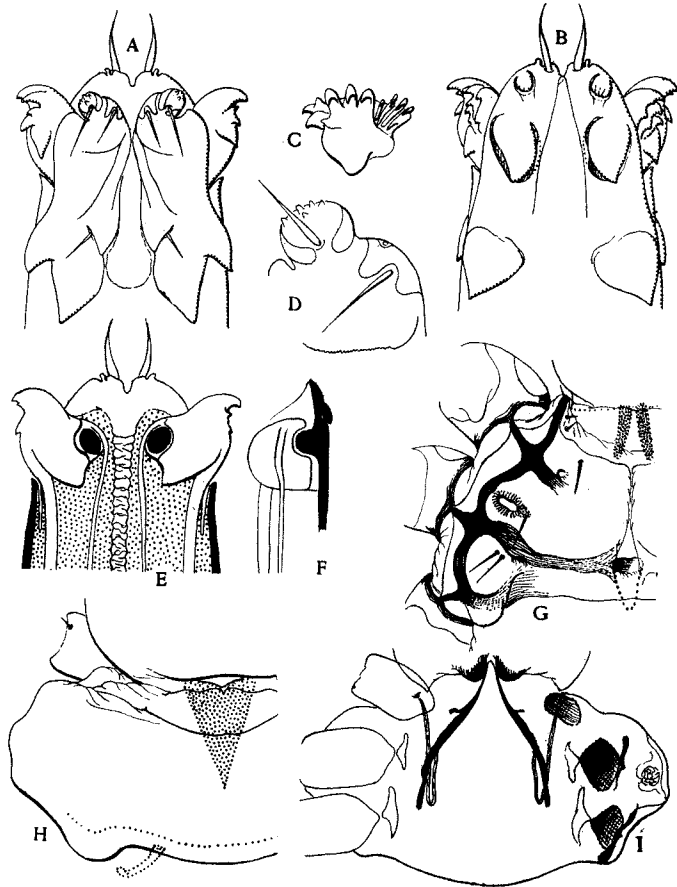


Fig. 2. Structural details of *Haematomyzus elephantis*. A. Ventral aspect of apex of proboscis. B. Dorsal aspect of same. C. Lateral aspect of mandible. D. Detail of palpus. E. Apex of proboscis with dorsal plate removed to show mandibles with their condyles and apodemes. F. Longitudinal section, diagrammatic, of apex of head to show position of mandibular condyle. H. Dorsum of thorax. I. Venter and internal apophyses of thorax, *Haematopinus suis*. G. Dorsum of thorax.

Arising between the bases of these two teeth-bearing structures there appears a rather conspicuous, somewhat sclerotic and wrinkled tube, which is obviously the oral tube and which extends posteriorly into the head capsule,

where it expands into a simple and somewhat sclerotic bulb, from which it proceeds as the delicate oesophagus. The bulb is evidently the pharynx. No salivary duct can be detected.

Lying within the proboscis there can be seen four more very delicate apodemes, the apical termination of which is obscured by the heavy pigmentation. They almost certainly insert upon some portion of the movable ventral plates.

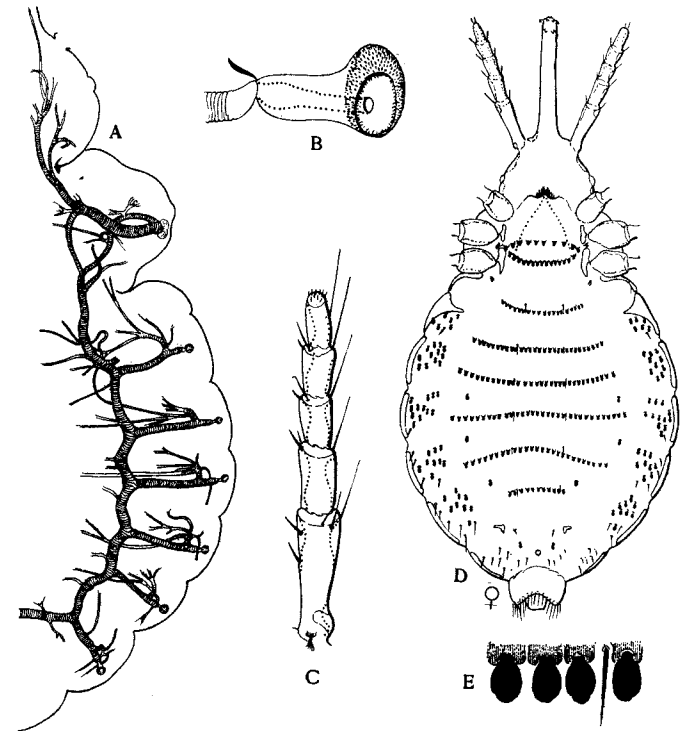


Fig. 3. *Haematomyzus elephantis*. A. Main trunks of right half of tracheal system. B. Spiracle. C. Antenna. D. Ventral aspect of female. E. Modified setae of the venter.

So much then for the bare description of what is present. It will be noted that these structures are fundamentally simple and that there is no series of complicated organs such as are present in the head of a typical sucking louse (Fig. 1 A). *Most particularly is it to be noted that the stabber sac with its contained piercing stylets, which is the most distinctive feature of the mouth-parts of a sucking louse, is here entirely lacking.* There are, in fact, no piercing organs whatsoever.

There remains the task of interpreting what is to be seen. As to this interpretation, it appears to the writer that there is but little room for difference of opinion.

That the toothed, lateral structures are mandibles is so obvious that there would seem to be no need to belabour the point. Their position, their form and even the transfer of the cutting or tearing edges to the outer side are directly parallel with the conditions found in the rhyncophorous beetles. A curious parallelism, indeed, but nothing more and to be stressed merely as facilitating an understanding of the conditions. The most curious feature of these mandibles is that of the position of the condyle (Figs. 2 E, F) which has moved inward

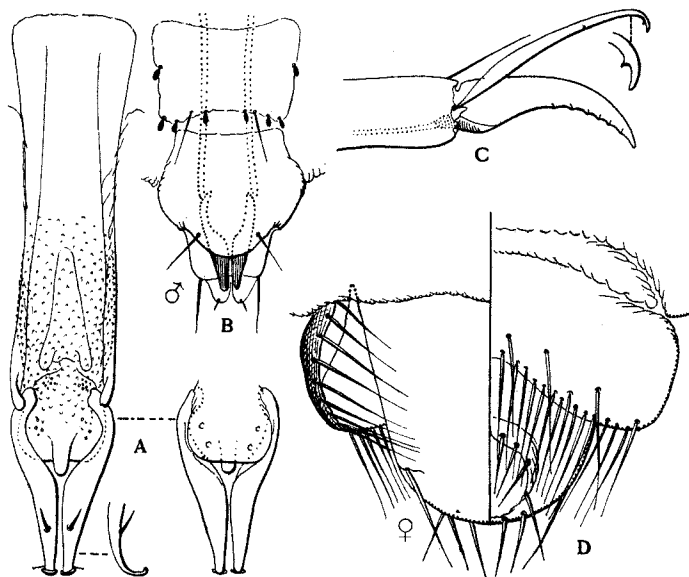


Fig. 4. *Haematomyzus elephantis*. A. Genitalia of male and details thereof. B. Ventral aspect of apex of abdomen of male. C. Apex of tarsus. D. Apex of abdomen of female, left half dorsal, right half ventral.

until it rises from the apparent dorsal wall of the head instead of from the lateral wall. Even this is paralleled to some extent in the shifting of the condyles in the weevil genus *Balaninus*.

So much is clear. That the dorsal plate can rightly be interpreted as the labrum is doubtful. Against such an interpretation is the fact that the mandibular condyles arise from it. In all probability the labrum and clypeus are lacking or are reduced to a narrow median area, and this plate is merely the apical termination of the frons, with the inclusion, perhaps, of a portion of the genae.

Also in connection with the ventral plates there is doubt. The apical, segmented lobes seem obviously to be the vestiges of palpi, but whether the bases from which they arise are the maxillae, with the labium represented by the ill-defined median plate, or whether the whole structure is the labium with the maxillae lacking, as they are supposed to be in some of the Mallophaga, is open to question. Evidence to settle the point might be obtained from the points of insertion of the four delicate apodemes which have been mentioned, but it has not been possible to trace these to their terminations. A study of the parallel developments in rhyncophorous beetles, if one dared to press conclusions far enough, might settle the point.

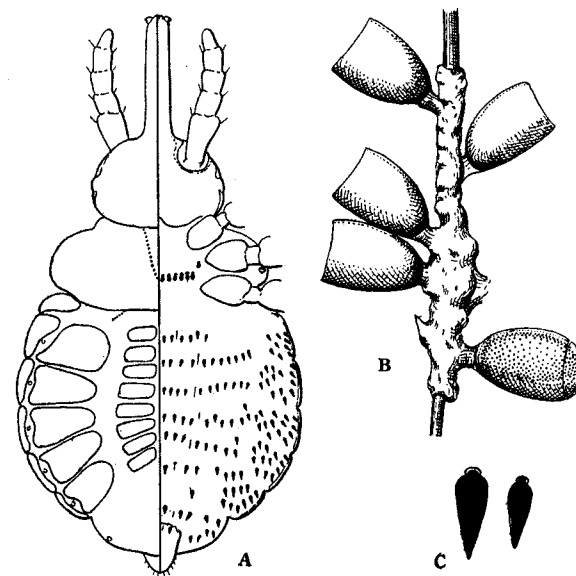


Fig. 5. *Haematomyzus elephantis*. A. Nymph, legs omitted. B. Eggs. C. Modified setae of the venter.

It is not the desire of the writer to be misunderstood as intimating that this insect has anything to do with the rhyncophorous beetles. It is a form with incomplete metamorphosis. But the curious parallelism between its head form and oral structures and those of such beetles contained the hint which led him to break away from all of the prepossessions which had caused him, like earlier workers, to accept the insect as a sucking louse and to enquire further into its structure. It would seem that in all probability this parallelism extends to the method of functioning of these parts as well as to their structure.

Somewhere in the vast literature of the rhyncophorous beetles there must be information concerning their exact mechanism of feeding, but it is not to be

found in general discussions of the group. Bearing in mind the extraordinary slenderness of the beak in some of these forms and the fact that down that beak must pass the apodemes of the mouth-parts, as well as the oral tube, we may conclude independently that many of these insects must ingest their food as a liquid by a sucking action, the mandibles being used to tear the food material and free the juices.

Such, in all probability, is the method of functioning in *H. elephantis*. Other writers, taking for granted the presence of the piercing stylets, have assumed that the elongation of the head is for the purpose of permitting the lengthening of these stylets in order that they may pierce through the thick skin of the host to reach the blood supply. Such an hypothesis can no longer be maintained. It would seem that the toothed mandibles are used to lacerate the derm, much as the terminal hooks are used in the ticks, that the blood is started flowing by such boring and the oral opening is merely applied to the wound and the blood sucked up by a pumping action of the pharynx. One may suspect that the insect probes with its beak into the folds of the skin of its host and that the apical teeth assist it to cling on a relatively hairless body.

The thorax.

The thorax is short and broad and dorsally is composed for the most part of a single, heavily sclerotic plate which bears no segmental lines or indications of divisions. A narrow anterior rim, which is pale and but slightly sclerotic, may be assumed to represent the pronotum, while the single plate may be assumed to represent the fused meso- and metanota. The lateral and posterior margins of this plate are sharply angulate and present a strongly sclerotic ventral marginal fold. There are no dorsal structures of any sort except a pair of short apophyses projecting into the body from the posterior border of this plate.

The legs attach on the ventral side, well back from the margin, the pleural condyles, except in the case of the first pair, arising from small, detached sclerotic areas (Fig. 2 I). It may be assumed that the region from these condyles to the lateral rim represents the true pleural region of the thorax and that the dorsal shield is the true notum.

There is but a single pair of thoracic spiracles, these being on the ventral side of the overhanging marginal shelf and almost directly in line with the mesothoracic coxal condyles.

There is no sternal plate, but at the mesal point of each middle and posterior coxa is a small, detached sclerotic area.

The ventral apophyses, which as the furcae are common to most pterygote insects and which in the Anoplura arise from the sternum near the anterior coxae, are here represented by an internal framework of peculiar position. It is, in fact, possibly not directly or at least entirely homologous with these apophyses at all. Arising from the median ventral lobes of the occipital foramen of the head, where they are solidly attached, are a pair of slender, strongly

sclerotic apophyses which pass posteriorly into the thorax as far as the level of the middle coxae and there divide. One short arm ends blindly. The other rises dorsally in a curve and then passes forward again to meet the coxal condyle of the corresponding anterior leg and by its ending in the body wall to form the pleural condyle upon which this coxa moves. A most curious arrangement, but so clearly demonstrated in several dissections that there is no doubt as to its occurrence.

It is not the intention here to discuss at length the thorax of the sucking lice, such a discussion being intended for another paper. But for purposes of comparison, a figure representing a portion of the dorsal aspect of the thorax of *Haematopinus suis* (Linnaeus) is presented. It is the writer's contention—which he will elsewhere elucidate and defend—that in the sucking lice the true notum is vestigial or even entirely suppressed, being at the most represented only by the narrow median line and the notal apophysis (Fig. 2 G) when this is present. All the remainder of the apparent notum appears to be composed of the fused pleural plates, the strengthening ribs being of the nature of phragmata formed along the lines of fusion of the epimera and episterna.

If the interpretations here given for the parts of the thorax be correct it is evident that there is a wide difference between *Haematomyzus* and the sucking lice.

The legs.

The legs of *Haematomyzus elephantis* depart widely from the form which is common to all the sucking lice. They are extremely slender, being in fact of a distinctly cursorial type, and entirely lack any provision for clinging to the hairs such as is characteristic of the short, stout legs of the Anoplura.

The attachment of the coxae to the thorax has already been discussed. The trochanters and femora present no features of interest. The tibiae are divided by a pseudo-articulation into two parts. Although these parts are sharply marked it is evident that there is no true articulation and no muscles are provided for the operation of the terminal portion.

The tarsi are more than half as long as their tibiae, are slender and cylindrical and terminate in a single stout claw which bears small teeth on its inner face. In addition to this claw (Fig. 4 C) there is another apical structure in the form of a curved, flattened seta which arises from beside the claw. The suggestion that this is in fact a second claw is inescapable because of its position, but it possesses no unguitactor plate and is entirely independent of the true claw.

The abdomen.

The abdomen in both sexes is broad and flattened and rather strongly sclerotic. There is sufficient difference between the sexes to make it desirable to deal with them separately.

Female. The segmentation is clearly indicated and there seems no particular reason for doubt as to the numbering of the segments. If we assume

that the genital opening of the female is between the eighth and ninth segments, the count of the pleurites from this point indicates that the true first segment is suppressed, the first apparent segment being morphologically the second. The ninth and tenth segments are closely fused into a small, truncate cone which is partially enveloped by the gonopophyses, can be telescoped within the body and bears the anus on the ventral side at the apex (Fig. 4 D). The spiracles are borne on the third (second apparent) to eighth segments on the dorsal side at the margin of the pleurites.

The pleurites are well-developed as distinct plates of more or less quadrate form on the morphological second to eighth segments, those of the first two segments being larger, the first extending somewhat on to the dorsal side, the second sending out a short arm on the ventral side. Dorsally on the third to seventh segments and separated from the pleurites by a narrow membranous area there is on each segment a large, triangular, sub-marginal plate. While almost the whole dorsum is somewhat sclerotic there are present a series of sharply defined and deeply pigmented median plates. That of the eighth segment is a large plate extending from one pleurite to the other. Those of the other segments are small and narrow. Their segmental distribution is not clear. The plate belonging to the morphological second segment is obviously marked off by an intersegmental furrow, but there remain seven plates to allocate to five segments, and the segmental folds are not sufficiently well defined to indicate to which they belong. At each end of the plate belonging to segment two is a small, detached, weakly sclerotic area bearing a pair of flattened setae.

On the ventral side the derm is squamate-reticulate and is entirely membranous except for two minute areas which are apparently on the posterior border of the seventh segment. There are six well-defined, transverse rows of short, flattened setae (Fig. 3 E) which apparently belong to the second to seventh segments, and at the lateral margin of each segment is an irregular group of these mingled with small, slender setae.

The gonopophyses arise as lobes from the posterior border of the eighth segment and are continuous across the ventral side, their margin being beset with long hairs. The genital opening, as has been demonstrated by probing of unmounted specimens, is concealed by the flap formed by these lobes. Within the body can be detected a small, circular, sclerotic area which probably surrounds the opening of the spermathecal duct into the uterus. The duct itself is too delicate to remain in cleared specimens.

Male. The abdomen of the male, while resembling that of the female in general form, differs markedly in appearance because of the enlargement and fusion of most of the tergal plates into a single large plate. This fusion involves the marginal and median plates of the morphological third to seventh segments, and the lines between the various plates are but faintly, although definitely, indicated. The first two and the last two median plates remain separate.

The ninth and tenth segments have somewhat the same conical form as in the female, the anus opening dorsally at the apex of the cone and being sur-

rounded by a sclerotic setigerous ring. The genital opening is immediately below the anus, in the ninth segment. The ventral side of the eighth and ninth segments bears a small, median genital plate (Fig. 4 B).

The genitalia of the male (Fig. 4 A) are of the type which is common to both the biting and the sucking lice. As in these groups, they consist of an extrusible membranous sac, the preputial sac or vesica penis, which bears numerous small, sclerotic placodes; the long basal plate, which forms a part of the wall of this sac; and the parameres which articulate to the apex of the basal plate and are basally continuous with the walls of the sac. The apex of the sac is slightly sclerotic, and within its walls is to be seen a narrow, elongate, sclerotic piece. The tips of the parameres are sharply curved upward and slightly back from their apices is a single stout, retrorse seta.

The tracheal system.

The position of the spiracles has already been pointed out. They are quite simple (Fig. 3 B), consisting apparently of a small chamber, the walls of which are beset with minute spines, this chamber opening into a thick-walled tube which communicates with a narrow opening that leads into the trachea. The closing apparatus, represented in cleared preparations by a minute, sclerotic bar, seems to be quite the same as has been described by various authors for the sucking lice.

The tracheal system (Fig. 3 A) consists of a pair of large lateral trunks connected by a single large commissure in the eighth abdominal segment and communicating with the spiracles by lateral branches. The main trunks are relatively little branched, the greater part of the branches arising from a common stem on each spiracular branch. The trunk rising from each thoracic spiracle is even larger than the lateral trunk, to which it unites by a triangular connection. It is not possible in the material at hand to identify more than the one transverse commissure. The entire arrangement is very similar to that in the genus *Haematopinus* of the sucking lice.

IMMATURE STAGES.

The material at hand contains a single specimen, belonging to the Hamburg Museum, which represents an immature stage. In its general features (Fig. 5 A) this is very similar to an adult. The mouth-parts and antennae are the same. The legs are somewhat shorter and stouter. The tergal plates are as in the adult female, except that the median plates are divided by a median line into two parts. The genitalia are, of course, not developed and the derm is in general less sclerotic than in the adult. The modified setae of the ventral side are proportionately much larger than in the adult and are cuneiform (Fig. 5 C).

A single slide, in the collection of the Hamburg Museum, contains a portion of a hair bearing several eggs and labelled as from "*Elephas sumatranus*." These eggs (Fig. 5 B) are of the characteristic type found in both the biting and sucking lice.

SYSTEMATIC POSITION OF *HAEMATOMYZUS*.

As will be clear from the foregoing account, especially that of the mouth-parts, *H. elephantis* can no longer be allowed to remain with the sucking lice. But ejected thus rudely from its abiding place of more than sixty years, it must be re-established somewhere. At the present time a certain amount of restraint in dealing with it is necessary.

There is first to be considered the possibility that it is the hitherto entirely unknown "missing link" between the biting and sucking lice. But it is clear that such an assignment is untenable. *The mouth-parts are strictly mandibulate.* Their only real peculiarities consist of the shifting of the mandibular condyles and of the cutting face of the mandibles themselves. And, as has been pointed out, this is paralleled in every way among such forms as the rhyncophorous beetles. The loss of the labrum is nothing unusual. And whatever interpretation may be given to the parts composing the ventral floor of the oral region, it can be paralleled elsewhere among mandibulate forms.

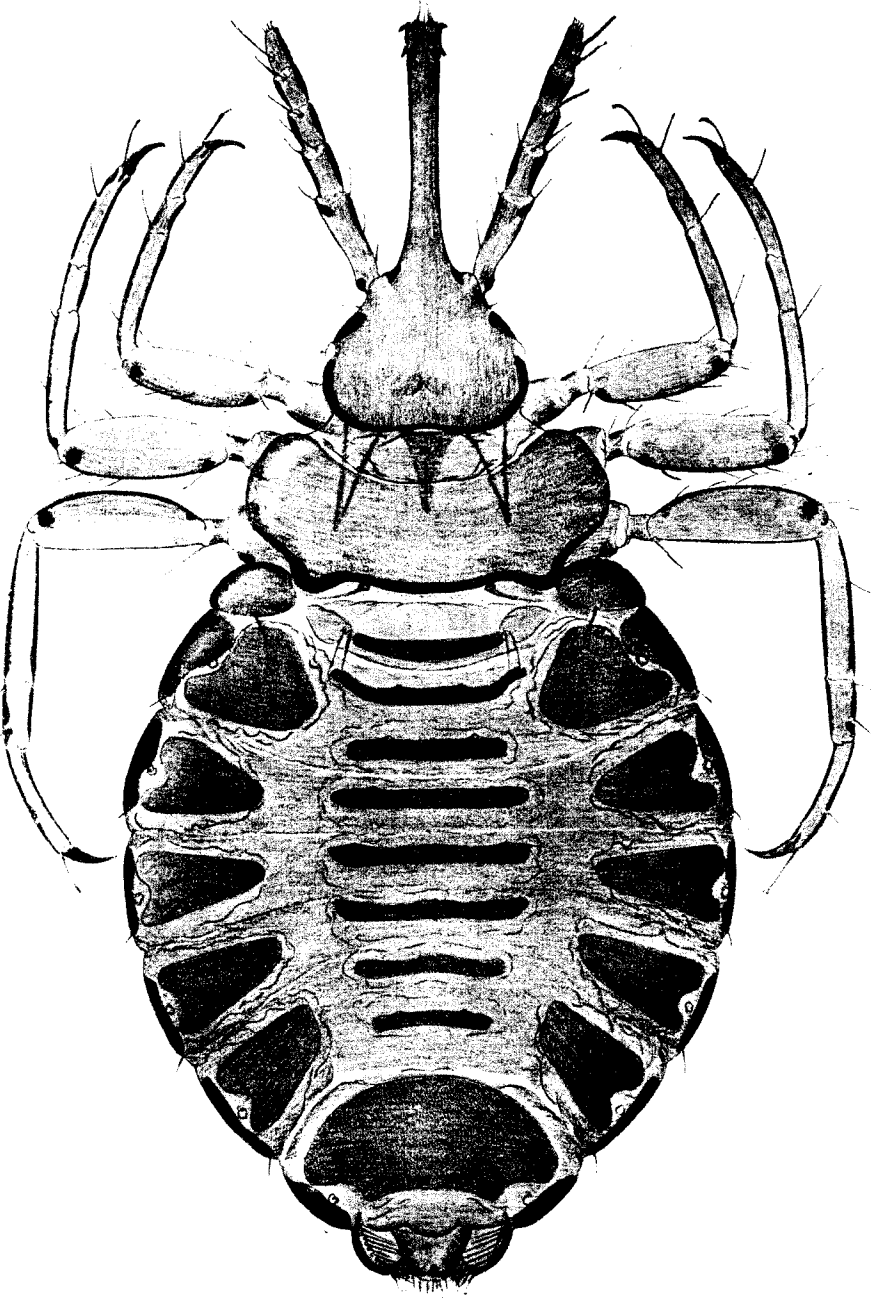
The mouth-parts, in fact, show not the slightest indication of a transition toward those of the sucking lice. Although functionally of a sucking type they contain no piercing mechanism.

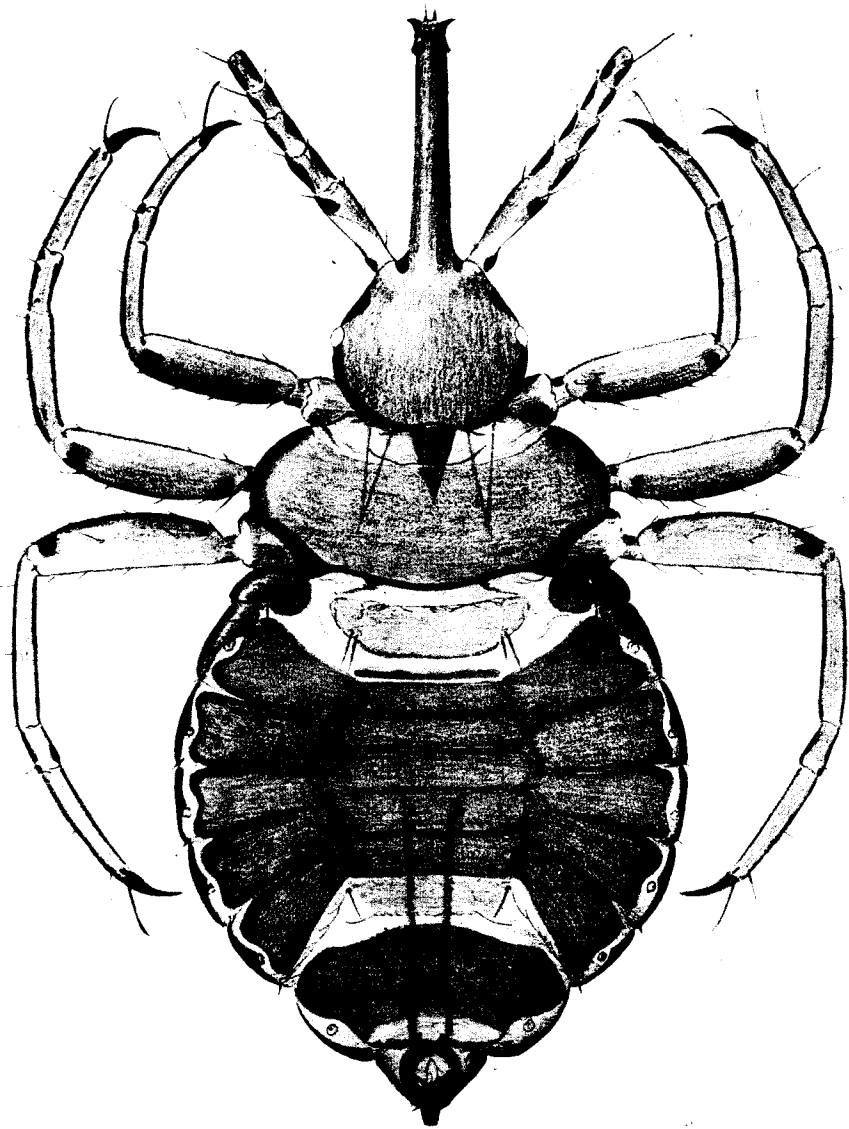
In certain respects, however, the insect recalls clearly the general characteristics of the Mallophaga and Anoplura. The five-segmented antennae are characteristic of both groups. The distribution of the spiracles, one thoracic pair and six abdominal pairs on the third to eighth segments, is that which is most common in both these groups. The tracheal system itself might be taken almost directly from a species of *Haematopinus*. The genitalia of the male might come from a member of either order.

On the other hand the thorax is characteristic of neither the Mallophaga nor the Anoplura, and there is certainly nothing in the Mallophaga having even the most remote resemblance to the curiously modified mouth-parts of *Haematomyzus*. Nor are the legs similar to anything which occurs in the Mallophaga, although the differences may possibly be regarded as purely adaptive.

There exist at the present time no morphological studies of any species of Mallophaga that are adequate for our needs in a situation such as this. It may be that such studies will show the impossibility of associating this species with the Mallophaga. However, the type of development and the broad morphological features associate the species in a general way with the biting lice.

It is the writer's belief—at present—that if we accept the Mallophaga and Anoplura as groups which have arisen from a common stem, as they apparently have, we probably see in *H. elephantis* the sole surviving vestige of a third branch from that same stem and equivalent in rank to either of the others. Consequently, if the Mallophaga and Anoplura be regarded as sub-orders of a single order, an arrangement which has some arguments in its favour, *Haematomyzus* would constitute a third sub-order of this group. Or, if it be preferred





to regard the Mallophaga and Anoplura as distinct orders in accord with the commonly accepted practice, a new order would need to be named for this one species.

But the naming of a new order is not to be undertaken lightly. Even if it eventually be regarded as justifiable it can very well wait until there exist more thorough comparative morphological studies of the Mallophaga and Anoplura than we have at present and until we have more information concerning *H. elephantis* itself.

As matters stand the only justifiable procedure is to attach the genus *Haematomyzus* to the Mallophaga, it being a louse with biting mouth-parts. But within that order its unique position should be recognised by placing it as a sub-order, for which I propose the name Rhyncophthirina. This sub-order will contain the single family Haematomyzidae Enderlein. And thus *Haematomyzus* may settle down for at least a time in a new resting place.

DESCRIPTION OF PLATES IV AND V.

Haematomyzus elephantis Piaget, female.

Haematomyzus elephantis Piaget, male.

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