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SPOLIA ZEYLANICA.

SINHALESE* EARTHENWARE.

By ANANDA K. COOMARASWAMY, D.Sc.

INTRODUCTION.

DURING the last three years I have made some study, chiefly in the Central and Sabaragamuwa Provinces, of the rather simple types of earthenware made and used by Siṉhalese for ceremonial, architectural, and domestic purposes. These types are more varied than might at first sight be supposed, and, apart from any question of painted pottery, will be found to possess much excellence in respect of beauty of form and adaptation to the end in view. This last consideration it is which determines the primary form of the vessels. Hardly any work of a merely ornamental character falls to be considered in the present paper. It is however this primarily utilitarian character and aim which give so much charm to the elegance of form and very simple decoration which accompany it; it has been said, indeed, that ugly pottery can only be made by an exertion of the cultivated intellect, and has only been so made in comparatively modern times. Much the same is true of India, where unglazed pottery is everywhere made for domestic and other purposes. Says Sir George Birdwood ["Industrial Arts of India"]: "Truest to nature in the directness and simplicity of its forms, and their adaptation to use, and purest in art, of all its homely and sumptuary handicrafts, is the pottery of India, and the forms of it shown on ancient Buddhist and Hindu sculptures, and the ancient Buddhist paint-

* Although my observations have been chiefly made in the Central and Sabaragamuwa Provinces, I have not used the word "Kandyan" in my title, because I should rather wish to emphasize the unity than the diversity of the Siṉhalese, and the low-country Siṉhalese have historically no less right to the tradition of ancient art than have the Kandyans, although various circumstances have contributed to its more complete and earlier decadence in the low-country

ings of Ajanta, are identical with those still everywhere thrown from the village hand-wheels." We do not however find in Ceylon the more elaborate types of glazed pottery made in some parts of India; but it will be found that Siṉhalese pottery fulfils the requirements of good workmanship in earthenware, viz., first, the vessel must be of a shape convenient for its purpose; secondly, that shape must be one that arises naturally from the mode of manufacture and exhibits to advantage the plastic properties of clay, without becoming weak or fanciful; thirdly, ornament should not interfere with usefulness and should be appropriate in amount and character in relation to the purpose of the vessel and the material it is made of; fourthly, smoothness of surface and elaborate refinements (however good in their right place) are not to be thought of as ends in themselves, and may appear unsuitable if striven for in vessels meant for ordinary daily use and made of a material not over fine. Nevertheless the application of some simple glaze would not be out of place, and it is perhaps rather strange that it is never met with in Ceylon.

It is by the foregoing standards then that Siṉhalese pottery should be judged, and not by others which are applicable to Chinese porcelain or Greek painted vases. This reminder is needed, lest the reader should feel a mistaken scorn for the rough homeliness and simplicity of the common earthenware I speak of.

The Potter.

The Siṉhalese potters (*baḍahẹlayo*) are found all over the country in every village affording the necessary clay, but often aggregated in greater numbers in places where an especially good supply of suitable clay is available. Thence the potter carries his pots for sale to more remote districts in huge pingo loads. Nowadays a good deal of pottery is taken in carts along the cart roads; in this way the fine red pots made by a settlement of Tamils at Nikapata near Haputale travel down the road to Balaṉgoḍa, and the Kẹḷaṇi pots with their white incised patterns come up to Ratnapura and Kẹ́galla and even Kandy.

Potters are usually in possession of lands held on service tenures, either directly from the king, or from the proprietor of a *nindagama*, or the grantee of a royal village, or they may owe service to a vihára or déwála. At the Kandyan court one of the household departments was that of the potters, where relays of men from the villages were kept constantly at work supplying the royal requirements. The following account of royal potters in the Four Kóraḷés is taken from Mr. Bell's "Report on the Kẹ́galla District," p. 112, where it is quoted

from Sir John D'Oyley's "Sketch of the Constitution of the Kandyan Kingdom" (T. R. A. S. London, vol. III., part II., 1833):—

"In Galboḍa Kóraḷé and Paraṇakúru Kóraḷé are eight potters under the orders of a *Vidána* of their own caste appointed by the Disáwa. In Kiňdigoḍa Kóraḷé and Beligal Kóraḷé are fourteen under another *Vidána*, but sometimes one *Vidána* is appointed over the potters of these three kóralés.

"The potters of the first division attend on duty in Kandy during one month at the *Mahá Gabaḍáwa*, and are then relieved by those of the second division, who serve one month more. During this period they are obliged to furnish as many earthen vessels (*valan*) as are required for the *Mahá Gabaḍáwa*, and to make tiles and bricks and perform any other potter's work required for the king's service. At their departure from duty each division supplies one hundred earthen vessels to the Disáwa's house.

"This two months' duty is performed in rotation with the potters of the upper districts, the Seven Kóraḷés, Úva, and Mátalé, and recurs once in ten months.

"In the Disáwani they are bound to furnish tiles, bricks, and all kinds of pottery for the Disáwa's use, and earthen vessels to the different resthouses (*váḍi*) when the king or ambassadors come into the Disáwani."

The following are examples of potters' services due to the proprietor of *nindagam* and to déwálas or viháras; at the village of Kinigama in Mátalé North, Dulḷewé Adigár owned seven *ninda paṇgu*. The services due from the three tenants (Arachchipaṇḍitayalágé, Badde Vidánayalágé, and Upàsaka Paṇḍitayalagé) of six of these were "at the old and new year to give a pingo of earthenware consisting of twelve small pots or a proportional number of large pots, and a separate *peṇuma* such as a goblet or jug, if the tenant is expert enough to make them, if not he brings forty leaves of betel; he repairs the roof of the *walawwa* with tiles provided by the proprietor; on great occasions, weddings, or devil dances he brings cooking vessels."*

In Koṭagepiṭiya a potter named Paṇḍitagé owed the following services to the Haňguraṇkeṭa Pattini Déwala for two *péḷas* of field and two *kuruṇis hén;* "yearly to give two *walankat* (pingo loads of pottery), one for the *perahera* and the other for the *alutsál;* to present a *walankada* to the Basnayàka Nilamé at the *perahera;* to make tiles when required (clay and firewood being supplied); to shift the tiles of the Déwála." † These services were commutable for Rs. 5·85.

* Lawrie, Gazetteer of the Central Province of Ceylon, p. 441.

† *Loc. cit.*, p. 476.

The Kuṇḍasále Vihára has one *Walandena Paṅguwa* in Walala. "Tenants: Paṇḍitagedara Komali. Services (commutable for Rs. 16·20): to supply for the four festivals eight pingos of earthenware, two for each festival, each pingo consists of two 'tali,' two *kaḷageḍi*, two *koras*, two *néṁbili*, two *batwalan*, three *lokuappalla*, six *appallapoḍi*, one *ćtiliya*, and one *dummala kabala*; for the *Alutsál Maṅgalya* to give four large *muṭṭi*; for the *Kaṭṭi Maṅgalya* fifty *kaṭṭipán*; for the *Nánumura Maṅgalya* two *ćṁbul muṭṭi*; after the new year to offer the incumbent six *appallapoḍi* and two *puñchi muṭṭi* as a *peṇuma*."*

These extracts will show the sort of work the potters did over and above what was required by themselves and the other villages for private use.

The potter may be found at work in the verandah of his house (Plate A, figs. 1 and 3)† or sometimes in a separate shed wholly devoted to the work.

The potter's appliances are, as may be supposed, simple enough. His wheel (*póruwa*) is a circular board about 2½ feet in diameter mounted on a stone pivot which fits into a larger stone socket embedded in the ground, the horizontal surface of the wheel itself standing not more than six inches above the ground. The wheel is turned by a boy (Plate A, fig. 1) who squats on the ground opposite the potter and keeps it going with his hands. A lump of clay is dumped on the wheel, enough for half a dozen or more pots, and they are moulded one by one under the potter's hands, cut off, and set aside to dry. To finish off the rims, a strip of wet cotton is used; with this the potter smooths off the edges as the wheel turns, and pressing through it with his nail, he makes the little mouldings at the top. As removed from the wheel the pots are bottomless and have to dry for a few hours or a day or two before they can be finished; when they are ready the potter takes a smooth stone (Text fig. I.) in his left hand and a sort of wooden bat (*walantaḷana léḷla*) in his right hand, and holding the stone inside the vessel he beats and pats its sides till finally they meet across the bottom; the vessel is rubbed smooth with the bat.

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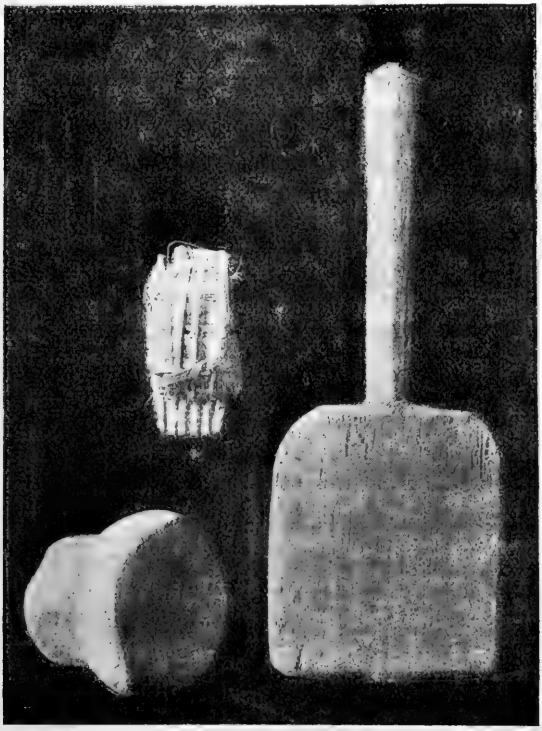
* *Loc. cit.*, p. 495: "Tali," plural of *taliya*, a dish or basin = usually metal, or *táliya*, a large pot or vessel of earthenware or metal, usually the latter; for *kaḷageḍiya*, *koraha*, *néṁbiliya*, *batwalaṅda*, &c., see below. The *Alutsál Maṅgalya* is the ceremony of fetching new rice; the *Kaṭṭi Maṅgalya* is the presentation of robes, &c.; the *Kaṭṭipán* appear to be the ordinary cocoanut oil lamps used on this occasion; the *Nónumura Maṅgalya* is an occasion of ceremonial bathing, and the *embul muṭṭi* are required to hold the lime juice, &c., used for washing the head; *peṇuma* is an extra gift or perquisite.

† The photographs are by Mrs. Coomaraswamy.

Occasionally the surface is polished by rubbing with a smooth seed. Any ornament required is now added and the pot is ready for the fire. Firing is done in a low kiln with stone sides and a dome covering of wet clay and sticks. The kiln is square in plan, and has three or four openings along one side for the insertion of fuel, and on the other sides smaller openings for the escape of air. Long sticks are used for fuel, pushed through the openings by degrees as they burn away. The kiln is usually protected from the weather by a rough shed.

Text Fig. I.



TOOLS USED BY POTTERS (*Balaṇgoḍa*).

The clay used is alluvial material such as is obtainable in most valley rice fields. The best kind is very dark and stiff; the colour after firing varies from a fine terracotta red to a rather unpleasant yellowish gray.

Domestic Pottery.

As Knox observed so long ago, the Siṇhalese are apt at making "all sorts of earthenware to boil, stew, fry, and fetch water in." Generic terms for all pots are *heḷiya* and *walaṇḍa*. They may be classified according to form into *kaḷagedi*, *muṭṭi*, *appalla*, and *eṭili*.

the *kalageḍiya* approaching a complete sphere, the others succesively shallower. The *kaḷageḍiya* is a water-carrying vessel indispensable to every family. Four examples are shown in Plate B, figs. 1–4. It is carried by women on the hip, the arm passing round the neck. The *muṭṭiya* has a wide mouth and is a vessel used for boiling rice. Plate B, fig. 5, shows a decorated *muṭṭiya* used for new rice at the *Alutsál Maṅgalya* at the Kuṇḍasálé Viháré. An ordinary *muṭṭiya* is seen on the worker's right hand in Plate A, fig. 2. *Muṭṭi* are used for other general purposes ; pots used to collect kitul syrup are for example called *ugamuṭṭi*. *Appalla* are shallower vessels used for cooking curries ; these are (larger) *lokuappalla* and (smaller) *appallapoḍi*. *Eṭili* are shallow pots for cooking curries (see Plate A, fig. 1) between the potters. A larger sort of broad shallow pan is used for cooking sweetmeats or other special purposes ; a variety with handles (called *kanbola eṭiliya*) is shown on Plate C, fig. 9 ; such a vessel corresponds to the English "preserving pan."

Beside the above-mentioned four types there are other vessels, of which the *néṁbiliya* (= námbu + heḷiya) is most important. This is a shallow dish with a rim projecting inwards and completely covered inside with an elegant arrangement of deep furrowings (Plate C, fig. 4). These are scored before firing by means of a rough wooden comb (*irigahana kaṭuwa*) (Text fig. I.), a process illustrated in plate A, fig. 4. The *néṁbiliya* is used for washing rice to remove stones and dirt, very much as a gemming basket is used to separate the heavier gem minerals from the common lighter constituents of the gravel. The fragments of grit, &c., remain behind in the grooves of the *néṁbiliya*, or are held back by its projecting rim, as the rice is stirred up in the water and gently poured over the edge ; this vessel is in daily use in every household. A similar vessel made to stand by the addition of a ring foot is called a *koraha* (one is seen on the worker's left hand in Plate A, fig. 4) ; the ring foot is not made in one piece with the rest of the vessel, but is added after the completion of the underside of the vessel as if for a *néṁbiliya ;* this vessel in this stage is inverted on the wheel and the ring of fresh clay added to form a foot.

A more typical *koraha* however is the larger type sometimes called *polkoraha* and shown on Plate B, fig. 6. These large pots are used for various general purposes, but especially by dhobies for washing clothes, and by mothers for washing their children.

A shallow dish with a ring foot (thus resembling the smaller type of *koraha* but without internal furrowing) is sometimes used for eating rice from and is called a *batwalaṅda*. A vessel rarely seen is the *pórnuwa* or oven (Plate B, fig. 7), a large three-legged affair with a big lid ; the interior is half filled with sand, and the oven is

said to be very efficient; the sand (as in the "sand bath" of the chemical laboratory) both retains the heat and preserves an even temperature.

A piece of earthenware only used locally is the *lipa*. This is a low cylindrical earthen stand replacing the three stones (*liggal*) which are usually used to raise the cooking pot above the fire upon the ground. Finally we have the elegant *gini kabala* or fire dish (plate C, fig. 8), which is a form rarely met with, but suitable for use as a small hearth, or to provide a fire for the goldsmith's blowpipe. The goldsmith, however, generally makes use of some commoner dish such as the smaller *koraha* to serve his purpose. A narrow-necked water vessel or goglet, generally rather rough in execution, is also sometimes met with. The list of domestic pottery is thus exhausted. It will be seen that it faithfully reflects the simplicity and lack of luxury characterizing the typical old-fashioned household. The vessels are few, and each serves some simple purpose for which it is specially adapted. The value of this rough earthenware is so small that breakages are not of very serious consequence. At the same time they are not very frequent. Indeed European residents will have observed that breakages of crockery by servants are much less frequent than in an English household. The ordinary price of a *kalagedi̯a* is about 20 to 25 cents, of a *nénḿbiliya* 6 to 15 cents, of a *koraha* 25 to 50 cents, and so forth.

Ecclesiastical Earthenware.

By ecclesiastical earthenware I mean the pots and vessels used especially in connection with vihára and dewála. Of these the most usual and most characteristic is the *kotalaya*; this is a spouted vessel used for holding the water with which flower offerings are sprinkled. Either an earthen or a bronze *kotalaya* may be found in every vihára; the bronze *kotala* are smaller and more elegant than the earthen. Figure 8 on plate B shows a decorated *kotalaya* from Dodantalé Vihára near Kégalla.

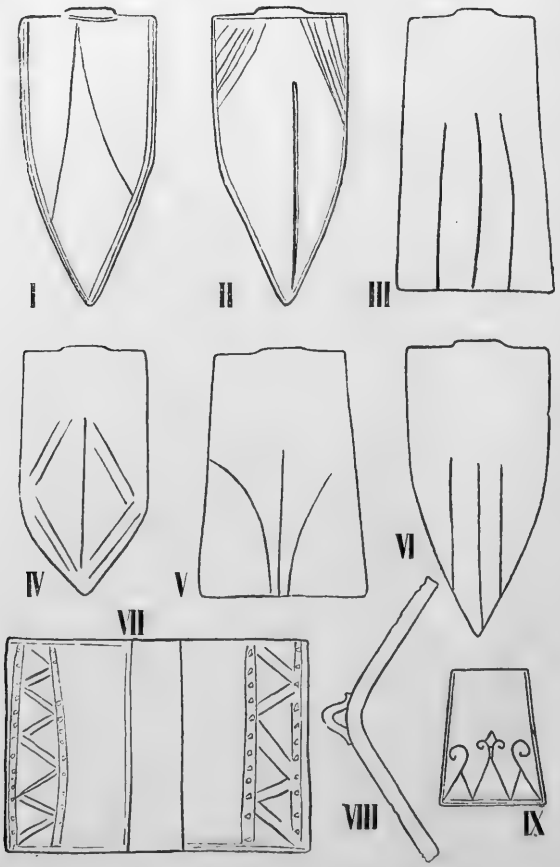
Very large wide-mouthed earthen vessels called *pátra* are found in most vihára and are used to hold water or to receive offerings of rice, &c., from worshippers. A very fine painted example is to be seen at Dodantale Vihára, but most specimens are plain or with very simple decoration of simple lines or of *bó* leaves in red. Earthen incense burners (*dummala kabal*), often of very elegant form and skilful execution, are used in dewála and vihára; the incense (powdered dummala resin) is sprinkled on burning charcoal carried on the *dummala kabala*. Two of these incense burners are shown in figs. 1 and 5, Plate C; fig. 1 illustrates a handsome example made by a Kandy potter only last year.

Other ecclesiastical earthenwares include lamps (*pahan*), chiefly the small plain shallow dishes for burning cocoanut oil with a cotton wick, and used in great quantities on festiveoccasions, being placed round the viháré or déwála compound in niches provided for the purpose in the walls. They are also set up on lampstands (*pánkañdu* —Plate C, fig. 6, the two right hand pictures) or protected from the wind in a lantern or cage (*pánkúḍuwa*) seen in the same figure on the left. Occasionally very handsome and elaborately ornamented *pánkañdu* are met with, bearing a larger lamp above with notches for three wicks. These tall stands are made in several pieces, fitting one on to the other, the whole tapering slightly towards the top.

Architectural Earthenware.

Here we have chiefly to deal with tiles (*uḷu*). The most characteristic and oldest type are flat. These tiles are of nearly oblong form,

Text Fig. II.



Kandyan Roofing and Coping Tiles.
I.–VI., Flat roofing tiles; VII., VIII., Plan and section of coping tile: IX., Plan of semi-cylindrical coping tile.
Scale of figs. I.–VIII., $\frac{1}{3}$ cm.= 1 inch. Scale of fig. IX., $\frac{1}{24}$ inch.

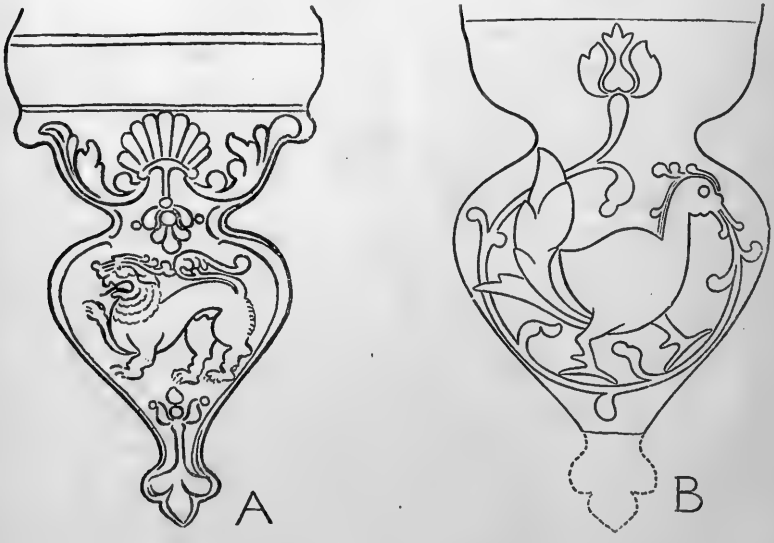
but taper slightly upwards, where a projection on the under side serves to keep them from slipping off the reepers. Other flat tiles are pointed at the lower end, and very beautiful roofs are often seen in which the pointed and square ended tiles are arranged on patterns or in alternate rows, giving great variety. Tile hangers are very clever in covering all sorts of awkward angles and steep slopes, and good old Kandyan roofs are consequently very picturesque, an effect which is greatly enhanced by the change of slope which is usually found and which corresponds to a structural feature of the timbering. We sometimes, but not very often, meet with especial bent coping tiles of a corresponding type. Flat tiles of the above types are usually ornamented with very simple parallel incised lines ; these seem to be a survival of the much deeper grooves which are to be seen on the old tiles so common at Sígiriya and Anuràdhapura ; the grooves were doubtless originally intended to facilitate the flow of rain water, but the simple incised lines found on Kandyan tiles are of no practical use for this purpose, and merely serve as an ornament, though not altogether a meaningless one, as the above remarks show. In Text fig. II. will be found illustrations of the tiles referred to

The roofing tiles most commonly seen nowadays however are semi-cylindrical in form, tapering slightly upwards. They are often associated with flat tiles on the same roof, and are generally used also for ridge or coping tiles. These semi-cylindrical tiles are less characteristic than the flat ones, but nevertheless quite pleasing and satisfactory. When used four or five thick they are a very efficient protection against heat, owing to the layers of air which occupy the spaces between the tiles ; they are generally so used in the northern districts. The new-fashioned Basel Mission and Mangalore tiles are perhaps slightly more convenient, especially in respect of leakage, but of course far less cool ; in addition to which their rigid form and mechanical effect are distinctly unpleasant. Instead of the slight curves and irregularities of a roof covered with ordinary tiles, we see what is practically a plane surface crossed by strictly parallel lines which are wearisome and uninteresting. The ordinary tiles if well burnt and well laid are much to be preferred in respect of appearance and comfort; though requiring slightly more attention, for in the services due to temples we see regular provision made for the annual shifting of tiles.

A special variety of tile is the eaves or hanging tile, used on dewála and viháré roofs to fringe the eaves (see Text fig. III.). These tiles have a plain flat upper portion which passes under the last row of tiles at the edge of the roof, and is inclined at an angle of about 110–120° to the visible down-hanging part of the tile which forms

the roof fringe and which is alone shown in the figures. The hanging part of these tiles is sometimes approximately square in form, Plate C., figs. 2, 3), but they have more often (as in Text fig. III.) the shape of conventionalized *bó* leaves. Animal figures, usually those of the lion (*siṇha*) and goose (*haṇsa*), are embossed on both the outer and inner surfaces of the hanging tile, but sometimes the inner less easily seen surface is left plain. This relievo decoration is effected by pressing down the tile on to a wooden mould on which the lion (found usually on the obverse) is engraved, the clay being pressed well into the mould from behind by the action of the fingers. The

Text fig. III.



KANDYAN EAVES-TILES.

A., Length 15½ inches. B., Length about 8½ inches.

addition of ornament on the reverse is now more difficult. The figure, usually a goose, is prepared in the same way by pressing soft clay into a suitable mould, but instead of the whole tile being so pressed against the mould, only the actual animal form is made, and when this is lifted off the mould it is applied to the back of the tile (the obverse of which has already been ornamented). The result of this pressing of both animal forms into hollow moulds is that when they are applied together back to back on the obverse and reverse of the tile there remains a hollow space within the tile, and between the two animal shells. It is usual to pierce a small round hole on the reverse side animal's body to admit of the escape of heated air when the tile is fired. The decoration tiles so made stands out in high relief, and shows up well in brilliant sunshine.

A simpler method results in the production of similarly decorated tiles with less relief. This result is attained by merely pressing the

clay tile between two wooden moulds. It is obvious that equally high relief cannot be obtained in this way as there is no way of pressing the clay into the hollows of a deep mould.

Rectangular tiles with lions or geese are used for the decoration of wall surfaces, and are then often painted to enhance their effect. Examples are to be seen at the Daḷadá Máligáwa and at the Old Palace, Kandy.

While speaking of roofs there must also be mentioned the handsome finials, often decorated with cobras, which complete the effect of a Kandyan roof. They are found on ambalams and on dewála and vihára roofs, where however the earthen finials are often replaced by more pretentious ones of gilt bronze. It should be remembered that in the old days only chiefs of the rank of a Disáwa were allowed to build tiled houses; much less was it usual to make use of finials on domestic roofs.* A story is told of a chief of the Hinidum pattu who proceeded to Kandy especially to obtain permission to have a tiled roof, but never returned, having been found guilty of some unnamed offence, apparently presumption, and beheaded!

Bricks (*gaḍol*) also must be briefly mentioned though not very widely used except in the erection of dágabas and for some other special purpose. It may be remarked that they are of the rather flat narrow form which is so much more satisfactory in appearance and makes a stronger wall than the bricks of more nearly equal dimensions which are now more generally used.

Mr. F. H. Modder has described the earthen rings (*úrákoṭṭa*) used for lining Kandyan wells called *úrá lin*. He says: "These wells are very common in the Kandyan district. They are circular in shape, about three feet in diameter, and instead of being built up with stone, earthen rings made by the village potter, and each about a foot and a half broad, are inserted and fitted in from the bottom of the well, increasing from two feet in diameter as they come up to the top to three feet. The earthen rings are called *úrákoṭṭa*, and the wells are known as *úrákeṭa lin*, abbreviated into *úrá lin*. The *úrákoṭṭa* help to keep the water cool, and if they could be made of larger dimensions so as to get into wells of all sizes, they would certainly be a useful and cheap substitute for stone. Each of the rings used at present can be made at a cost of about 37½ cents, and the cost of a well thus built would not exceed a couple of rupees."†

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* *Cf.* Trans. R. A. S., London, vol. III., 1833, p. 488, footnote; and Philalethes and Knox, p. 192.

† Journal, C. B., R. A. S., vol. XIII., No. 44, 1893, p. 38.

Decoration of Pottery.

Under this heading I propose to describe the ordinary methods of ornamenting earthen vessels, referring only to such decoration as is applied before firing. What is ordinarily known as painted Kandyan pottery is painted with oil colours after the pots are fired, and this work will not be referred to in the present section. Leaving that oil-painted pottery aside, the decoration of pots may be classed as incised, stamped, and slip-painted. The simplest form of slip-painting is the application of concentric bands of red, to apply which the vessel is inverted on the wheel, which is revolved slowly while the brush is held against it (see Plate A, fig. 3, where a *kaḷageḍiya* is being thus treated). The red paint is made by grinding up with water certain ferruginous nodules and concretions called *gurugal*, while white paint is similarly made from kaolin. Beside the plain stripes, simple geometrical ornaments in red or white is sometimes seen, as on the *pórṇuwa*, Plate B, fig. 7. Black stripes are sometimes done with graphite. Incised ornament, if more than a mere concentric line, is usually combined with the red striped painting

Text fig. IV.

Decoration of a Kaḷageḍiya. (*From Peḷmaḍulla.*)

The pot is allowed to get very hard and dry and the pattern then engraved on the red bands with a sharp tool. Plate B, fig. 2, shows a *kaḷageḍiya* so treated. This vessel is ornamented with alternate concentric stripes of red and gray; the incised ornament (see Text fig. IV.) is added on the red bands, of which the uppermost has geometrical forms only, the middle conventional creeper (*weḷ*), and the ornament on the lowest red band consists of fishes alternating with a sort of inverted trident; on a still lower zone, a few upright lines appear in widely separated groups. The pattern (after burning) stands out on the lighter colour of the plain clay, against the darker red due to the *gurugala* paint.

Highly finished water vessels (*kaḷagedi*) are made at Kęḷaṇiya, and on these the incised decoration reaches its highest level of design

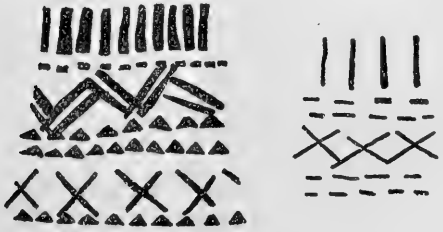
Text fig. V.

Decoration of a Kaḷagediya. (*From Kęḷaniya.*)

and execution. Text figure V. shows part of the incised ornament on such a pot. The remarkably Greek appearance of this design will be remarked; this is a subject which I shall deal with in greater detail elsewhere.* The Kęḷaṇi pottery is much appreciated, and as already stated travels far and wide. There is also made a great variety of grotesque animals, toys, money boxes, &c., which hardly call for further notice on the present occasion.

The most beautiful decoration however is put on with wooden stamps (*achchu*), which are of varied form. The simplest are merely

Text fig. VI.



Decoration of Kaḷagedi. (*From Kolonná Kóraḷé.*)

blunt wooden chisels with which simple various arrangements of lines are formed, as in text figure VI. taken from two pots at Kolonnàwa;

* Journal, C. B., R. A. S., 1906.

in one of these a small triangular stamp is also used. Text figure VII. is from another Kolonná *kaḷageḍiya* which is shown in full on

Text fig. VII.

DECORATION OF A KAḶAGEḌIYA. (*From Kolonná Kóralé.*)

Plate B, fig. 3; we have here an elaborate rosette beside some other simpler forms. Text figure VIII., from the *muṭṭiya* of Plate

Text fig. VIII.

DECORATION OF A MUṬṬIYA. (*From Kundasále Pansala.*)

B, fig. 5 (from Kuṇḍasále), and fig. IX., from Plate B, fig. 1 (from near Balaṅgoḍa), show the still more excellent type of stamped decoration with conventionalized *bó* leaf forms, in addition to simple lines and rosettes. The *kotalaya* of Plate B, fig. 8, is also ornamented with *bó* leaves and rosettes. The universal application of the *bó* leaf decoration in all sorts of Kandyan work is really remarkable; its outline can be recognized sometimes only with difficulty; at other times it is exceedingly obvious. We have already seen certain hanging tiles of this form, and now find it again as a stamp.

Text fig. IX.

Ornament of a Kaḷagediya. (*From near Balaṅgoḍa.*)

One special form of incised ornament has already been referred to, *i.e.*, the furrowing inside *nę̆m̆bili*. The utilitarian object of this grooving has been indicated, but nevertheless the arrangement of the groovings will be found to differ much in various specimens, and always to be elegant and decorative.

The incised ornamentation of tiles has also been referred to above; examples are shown in Text figure II., where Nos. 1–6 represent flat roofing tiles, Nos. 7 and 8 a coping or ridge tile in plan and section, and No. 9 a semi-cylindrical ridge tile with incised ornament, such as is only very rarely met with however on the curved tiles.

Before leaving the subject of stamped ornament, brief reference must be made to the finger-mark decoration seen on the larger *koraha* of Plate B, fig. 6, a type of decoration often seen on the modern flowerpots also.

Painted Pottery.

The general subject of painted pottery lies somewhat outside the scope of the present paper; for the painting is of the same character as that applied to book covers, woodwork, and other objects, and is applied to earthenware only after it has left the potter's hands.

The best work has been done in the Kandy District, but comparatively little of real delicacy is now met with, while a great deal of careless gaudy stuff is to be seen. Tall classical amphoræ too are now largely made and painted, usually very badly, and considering their exotic form and poor decoration are not very pleasing.

Some painted earthenware appears to be intended merely to serve as decorative objects,and not intended for use ; other sorts are specially made for use, such as various jars and vessels with lids convenient for keeping betel leaves fresh, some varieties of *pánkanda*, and a complex form of cobra-decorated lamp, holding many wicks, used by devil dancers and called *púnákalé*. The only colours properly used in painting pottery are red, yellow, white, and black, *i.e.*, the ordinary pigments of the Kandyan painter. The designs and decoration are also identical with those found in other paintings, so that there is no need to describe them in further detail upon the present occasion.

Conclusion.

The subject of Siṇhalese (especially Kandyan) pottery has now been reviewed in some detail, although there are many points on which fuller information would be desirable. A full account of early types of earthenware found at Sígiri, Anurádhapura, and elsewhere would be of great value and interest. It is also possible that I have overlooked some forms of earthenware to be found in other districts than those (chiefly Sabaragamuwa and the Central Province) which I have especially studied. I have found, however, that once a familiarity with the typical forms had been obtained, I scarcely ever met with aberrant or unusual forms ; in other words there is great fixity of type, and we do not find individual potters experimenting on their own account, probably because the fixed types exactly fulfilled the purposes for which they were required, and it would not occur to the potter to work for mere amusement or for the production of beautiful forms apart from practical ends. Nor was the material available, or the potter's skill sufficient, to so interest the leisured or more wealthy classes as to lead to a demand for decorative pottery considered apart from ordinary household requirements.

The most elaborate earthenware we meet with is made for use in connection with religious buildings, for the needs of which the king or other rich patrons were willing to secure the services of all the best workmen, or for which the potter was willing to work unpaid, or to which he had to supply earthenware as a service rent.

The reader will have already observed that the art of pottery has degenerated far less than the other Siṇhalese industrial arts, and though there is nowadays little demand for good work in decorated

finials, imposing lampstands or moulded eaves-tiles, the potter's ordinary wares have not changed much, either lately, or probably even for a very long time. We may congratulate ourselves then that Siṇhalese pottery has so far degenerated very little; this is mainly because it is so cheap and so intimately adapted to local requirements as not to invite the competition of imported machine-made wares. Unfortunately, however, the kerosine tin has made some progress, and is commonly seen in use instead of a *kaḷageḍiya*. This is pitiful, but less fatal than a degeneration of form in the *kaḷageḍiya* itself. The growing use of Basel Mission and Mangalore tiles is more to be regretted, no less on the score of comfort than of appearance; an ancient building re-covered with such tiles, perhaps subscribed for at considerable cost by poor village contributors to some vihára funds, is robbed of most of its distinctive character. Is it too much to ask those concerned to take a little trouble and exercise some thought in dealing with such buildings? Now that the old sumptuary laws forbidding tiled roofs to any but Disáwas are no longer in force, the builder of a new house might even, if he cared to do so, make it beautiful by giving due consideration to its roof. Unfortunately the elements of beauty or dignity, which may enter into even such homely matters, are the last which are likely to influence him; and at the same time the capacity for good work in making and laying tiles is dying out, so that it is increasingly difficult to get it, and a majority of persons are scarcely aware that good work ever was done, or can recognize it when they see it. I need hardly add that this applies with equal or even greater force to almost every aspect of old Siṇhalese art.

Explanation of Plates A, B, and C.

SIṆHALESE EARTHENWARE FROM KANDYAN DISTRICTS.

Plate A.—MANUFACTURE OF EARTHENWARE.

1. Potters at work in verandah of house; a *muṭṭiya* on the wheel, *ṭili* behind, between the potters. Dumbara.

2. Completing the underside of a *nĕṁbiliya; muṭṭiya* holding water seen on worker's right.

3. Painting red stripes on *kaḷageḍiya;* other *kaḷageḍi* in the foreground, stacks of *muṭṭi* behind; potter working in house verandah. Mádampe.

4. Scoring furrows inside *nĕṁbili* and *koras* (photographs 2 and 4 taken outside potter's shed owing to darkness of interior), Balaṉgoḍa.

Plate B.

Figs. 1–4, *Kaḷagedi.*

1. With stamped *bó* leaf ornament; from Alutnuwara, Balaṉgoḍa.

2. With incised ornament and red and black stripes; from Peḷmaḍulla.

3. With stamped ornament; from Kolonnáwa.

4. With stamped ornament; form recalls by its angularity waterpots of the Tamil fashion; from Peḷmaḍulla.

5. *Muṭṭiya* with stamped *bó* leaf and rosette ornament used for new rice at *Alutsál Mańgalya.* Kuṇḍasále near Kandy.

6. *Koraha;* 10½ in. high, 16 in. across mouth. Mahawalaṭenna, Balaṉgoḍa.

7. *Pórṇuwa.* Kégalla.

8. *Kotalaya*, with stamped *bó* leaf ornament. Doḍantale Vihára, near Kégalla.

Plate C.

1. *Dummála kabala.* Kandy, 1905.

2. and 3. Obverse and reverse of hanging portion of eaves tile in high relief; observe small hole in centre of goose to allow of escape of air in burning, there being a hollow space between goose and lion; tile 6¾ in. wide; from Daḷadá Máligáwa, Kandy.

4. Inside of *néṁbili* showing furrows. Kandy.

5. *Dummala kabala.* Alutnuwara Déwála, near Balaṉgoḍa.

6. *Pánkúḍuwa* (lantern) and two *pánkaṅḍu* (lampstands). Maṉgalagama, near Kégalla.

7. Coping or ridge tile with incised ornament. Alutnuwara Déwála, Balaṉgoḍa.

8. *Gini kabala* (fire dish); diameter 12 in. Mahawalaṭenna, Balaṉgoḍa.

9. *Kan bola ṭiliya* (preserving pan); diameter 16 in. Mahawalaṭenna, Balaṉgoḍa.

1 POTTERS AT WORK AT DUMBARA.

2 COMPLETING UNDER-SIDE OF "NEMBILI," BALANGODA.

3 PAINTING STRIPES ON POTTERY AT MADAMPE.

4 SCORING INNER SURFACE OF "NEMBILI," BALANGODA.

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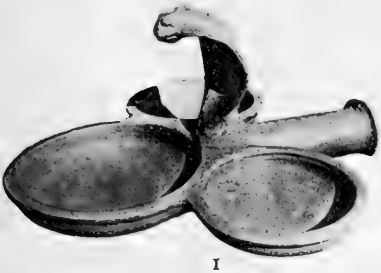
KANDYAN POTTERY. (A. K. Coomaraswamy).

Bemrose Ltd., Derby, Eng.



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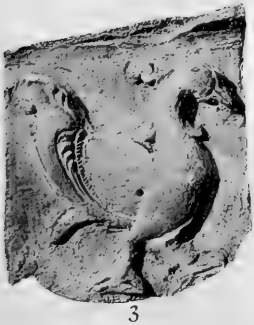

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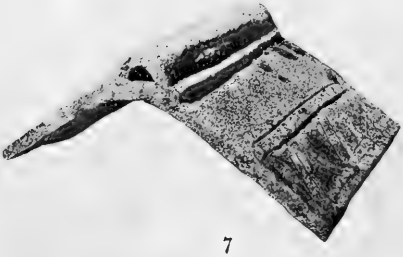

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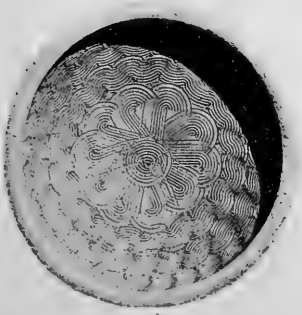

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KANDYAN POTTERY. (A. K. Coomaraswamy).

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HYBRIDIZATION EXPERIMENTS WITH THE CEYLON JUNGLE FOWL.

By J. Llewellyn Thomas, F.R.C.S., Eng.

THE Ceylon jungle fowl, *Gallus Stanleyii*, or perhaps more generally known as the *Gallus Lafayettii*, is one of the four varieties of jungle fowl found in Asia. From one or more of these four all domestic poultry have had their origin. The Ceylon bird was one of the competitors for the honour of being the (or one of the) parent stocks of domestic fowls. The origin of the domestic fowl is one of considerable interest, and has received the attention of some of our most distinguished naturalists, chief among them being Darwin, who gave his great mind to the investigation of the subject. His conclusions were largely drawn from the experiments of others, and in some quarters it has been felt that he had insufficient data placed before him for the perfect prosecution of his investigations, and some of his conclusions have been accepted with considerable reserve by men of some authority in the poultry world. The question of the origin of modern pigeons has been settled beyond all dispute by Darwin, but the origin of the domestic fowl was not quite so easy of solution. He himself says : " We have not such good evidence with fowls as with pigeons of all breeds having descended from a single primitive stock."

The four varieties of jungle fowl are—

(1) *Gallus bankiva* (*or ferrugineus*).
(2) *Gallus Stanleyii* (*or Lafayettii*).
(3) *Gallus Sonnerati*.
(4) *Gallus furcatus* (*or varius*).

In considering the claim of these various breeds to be the parent stock of domestic poultry, the points on which stress is laid are, the comb, the wattles, the hackle feathers, the colouring, the voice of the bird, and lastly the great question of its power to breed with the domestic fowl, the power of the progeny so produced to breed

with either parent stock; and above all the power of the progeny to breed amongst themselves. This last is supposed to be the severest test of unity of species.

Darwin concludes his investigation by stating that the *Gallus bankiva*, the great jungle fowl of India, is the parent stock. This view is generally accepted as correct. He then gives reasons why the other three probably are not parent stocks. It is these conclusions that are received with much hesitation. In the present article we are concerned only with the *Gallus Stanleyii*.

In "Animals and Plants under Domestication," Vol. I., p. 246, Darwin writes :—

"Ceylon possesses a fowl peculiar to the Island, viz., *Gallus Stanleyii;* the species approaches so closely (except in colouring of the comb) to the domestic fowl that Messrs. Layard and Kelaart would have considered it, as they inform me, as one of the parent stocks had it not been for its singular voice.

"This bird, like the last (*Gallus Sonnerati*), crosses readily with tame hens, and even visits solitary farms and ravishes them. Two hybrids, a male and a female, thus produced were found by Mr. Mitford to be quite sterile; both inherited the peculiar voice of the *Gallus Stanleyii*. This species *may in all probability* be rejected as one of the primitive stocks of the domestic fowl."

In appearance the bird does very closely indeed approach the domestic fowl. The three points urged against its being a parent stock are—

(1) Unique comb; a fairly large single comb with an orange centre, this latter being found in no domestic fowls.
(2) Its voice, which is not like an ordinary cock crow, but a curious call popularly said to be like the words "George Joyce."
(3) The sterility of its hybrids.

Let it be well noted that Darwin makes no positive statement; he does not dogmatize. He merely says: "This species *may then in all probability* be rejected," &c. He was open to conviction.

Discussing these points, the late Lewis Wright, one of the greatest authorities in poultry matters, writes in the 1893 edition of his colossal standard work, "The Book of Poultry," p. 504 :—

"Regarding the Ceylon jungle fowl, or *Gallus Stanleyii*, there is less evidence on either side. The fact that hybrids between it and the common fowl are so common in Ceylon as scarcely to excite remark, should make us cautious in concluding, on the sole evidence

of two individuals mentioned by Mr. Mitford, that such hybrids are sterile; and on this point many of our observations on the *Gallus Sonnerati*, as to the difficulty of breeding from wild birds or their descendants in captivity, will peculiarly apply, for it will be noted that the wild breed itself is stated never to have bred in such circumstances, or even to have long survived. Hence we might expect great difficulty in breeding from its hybrids, quite apart from any actual sterility. The great difference in the voice is of more weight, but will be thought much less of by a poultry fancier, who is accustomed to the most extraordinary differences between the voices of various domestic races, than by a naturalist. On the whole it must be admitted that there is very little evidence to show either that the *Gallus Stanleyii* had or had not any share in the origin of the domestic fowl, though it is worthy of remark that the resemblance of the bird itself is perhaps the most startling of all the wild breeds; so that Messrs. Layard and Kelaart mention the "George Joyce" crow as the sole reason for discarding it as one of the parent stocks. This reason, however, as we have remarked, a fancier would consider very insufficient if unsupported by others. In relation to this breed, it is also decidedly worthy of remark that in most cases of reversion in colour amongst various breeds of poultry, the evident tendency is towards a *red or brown breast** in the cock rather than to a black. This fact we have already pointed out; and, so far as it goes, it is more in favour of the present variety than of the *Gallus bankiva* as a possible parent of our domestic breeds."

The sterility of the hybrids rests entirely on the evidence of two specimens. The data placed before Darwin are the *one single* experiment made by Mr. Mitford, who failed to breed from two hybrids! One swallow does not make summer, and *one* experiment by Mr. Mitford does not settle the question of the sterility of these hybrids.

On 25th October, 1902, a letter appeared in the "*Times of Ceylon*" suggesting that the newly-formed Ceylon Poultry Club should endeavour through its members to investigate this subject; that accurate scientific experiments should be made to furnish sufficient data to form a solid opinion and so either to establish Darwin's suggestion as a solid fact or to demolish it as untenable.

The matter was taken up by the Club, and certain members undertook to work at the problem. The inaugural meeting was held on 16th December, 1902, at the Colombo Museum, under the presidency of the Director, Dr. A. Willey, F.R.S., and there were present

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* *Gallus bankiva* is invariably black breasted; the *Gallus Stanleyii* is yellowish red.

Major Firminger, Messrs. S. P. Jeffrey, P. D. Warren, A. Redemann, F. Lewis, and Drs. A. J. Chalmers and J. Llewellyn Thomas. The actual experiments commenced in January, 1903. Covered-in runs were put up by several members and were made suitable with shade and cover for the wild birds. Many birds were brought by natives which were said to be hybrids. None however gave any evidence of jungle fowl parentage, save perhaps one ; these of course were not accepted. Some of these interviews with the native vendors were really amusing. For scientific purposes all these so-called hybrids were utterly useless, and it became evident that no bird was to be trusted unless there was positive proof of its parentage, and the only way to ensure this was to begin *de novo* and first make the hybrids.

It was necessary first to secure the wild birds, tame them down, and mate them up with domestic fowls. Attempts were made to produce the hybrids both ways, *i.e.*, by mating the jungle cock with domestic hens and by the domestic cock with jungle hens. This latter way was a complete failure ; the wild hens would never stand for the domestic cock. On the whole, too, it was found that the jungle cocks seemed to be more amenable in captivity than the jungle hens. On the other hand, one of the experimenters, the late Mr. Young, of Udabage, had two hens that lived in captivity for considerably more than one year.

As much difficulty was anticipated in keeping alive and of taming down the adult jungle fowl, attempts were made to secure jungle fowl eggs and incubate them. The eggs of course were not easy to secure, and in those cases in which they were procured one thing or another spoiled the hatch, so that the experimenters were reduced to purchasing the captured wild fowl.

Many and many of these birds died—some did not survive their capture by many days. Several survived six weeks or so and then died just when hopes of their taming down were high. It was noted at the time that these deaths occurred mostly about the fiftieth day of captivity ; this probably was a mere coincidence. The causes of death were probably fretting and pining for liberty, too small runs, and over-feeding. At first the experimenters were only just feeling their way and many things were learnt by bitter experience, which would be avoided on a future occasion.

The histories of some of these birds were very interesting, but have no bearing on the main issue. The constant failure by deaths was very discouraging, with the result that the experimenters were reduced to two or three. The untimely death of Mr. Young of Udabage by lightning was a great blow to these experiments. Only

in one run was there any success, namely, in that of Mr. Clement Johnson, lately of Hunasgeria. This was an ideal run, of large size, with ample shade and cover and with a little stream running through it. It was surrounded and covered in by one-inch mesh wire netting, which has been proved to be better than netting of larger mesh. Mr. Johnson, in the first two years succeeded in producing in all some twenty-five or thirty hybrid chicks. He had a remarkable jungle cock which he mated up with several (three) domestic hens in this run. This cock, as the bird does in its wild state, only took up with one single hen and bravely ignored all the others. From this one pair came all the hybrids. In the wild state the jungle cock is known to tread the domestic hens in outlying villages, but this bird was never seen to touch any but his one special hen.

Many of these hybrids died, some at an early age and some when older. Some perished by wild cats tearing through the wire netting and getting at them. Others perished during the very severe monsoon rains. Chicken-pox and gapes also claimed their victims.

The following is Mr. Johnson's description of these chicks when quite young. These chicks are very small in size and are remarkably active. They are all marked alike and very like pure jungle chicks in appearance, perhaps a little lighter in colour. "The little beggars are just two weeks old, and they are already out of control; they will fly anywhere; I found them yesterday all perched up in a tree twelve feet from the ground, the disconsolate mother hen below. Fortunately, they follow her still or they would disappear entirely. At an alarm they scatter in all directions like a flash. With care you can approach them quite closely like ordinary chickens; any untoward movement however and they are off to cover. They are the jolliest little chaps you ever saw."

It may be stated here that every one of the hybrids bred by Mr. Johnson took almost entirely after the jungle parent. The pullets turned out like jungle hens, so great the likeness that when seen apart these hybrids were invariably mistaken for jungle hens. The same might be said of the hybrid cocks. The plumage was very similar. None had such orange centres of comb as the wild birds, but there was in some an attempt at the yellow patch. This mark only appeared in the hybrids after they were full grown, and since many died young it is impossible to say what they would have been like. The purple patch at the throat of the wild male was observed in one of the cocks, while in the others it was merely a dark patch. As to the voice—all the pullets had the voice of the wild hen. The cock's call was very strange, hard to describe; it was

neither that of the wild bird nor yet the honest crow of the barndoor cock—something midway between the two.

The cockerels and pullets are very hard to distinguish till after the age of three months. The earliest sign of a cockerel was the appearance of a red sheen on the feathers of apparent pullets; all such birds in a month or two turned out to be cockerels. The colour of the tarsi was generally yellow like the wild fowl, but many came of a willow or dark gray colour. On the average the hybrid males and females were a shade bigger than the corresponding jungle birds.

The general impression was that these birds (according to Darwin) were to be sterile, for Darwin, in closing his general argument, says: "The four known species of *Gallus* when crossed with each other, or when crossed (with the exception of *Gallus bankiva*) with domestic fowl, produce infertile hybrids."

Does he mean infertile when bred with either parent, or does he only mean infertile when crossed *inter se?*

It is the opinion of natives here that the hybrids will certainly breed with domestic poultry, and the doubt has never entered their minds but that the hybrids will breed *inter se*. This mere opinion is however really valueless, as it has never been demonstrated by strictest scientific investigation and experiment.

We now come to the actual experiments; they were carried on in Hunasgeria, Matale District; Atgalla, Gampola; and Queensdown, Colombo. Mr. Johnson's runs at Hunasgeria were closed in April, 1905, with the departure of this experimenter to England—a great loss to investigators. His stock was distributed between the Atgalla and Queensdown runs.

No. 1.—Hybrid Cock and Domestic Hen.

All the hybrid cocks have been mated up at one time or another in different runs with domestic hens and in every single case fertile eggs have been produced, and strong healthy chicks hatched out. The hybrid cocks are quite fertile with the domestic parent.

No. 2.—Hybrid Cock and ($J\ \frac{1}{4} + D\ \frac{3}{4}$) *Hen.*

The progeny of the hybrid cock and domestic hen produced in No. 1 may be said to be three quarters domestic and one quarter jungle. Such a pullet was mated up with a hybrid cock. She laid fertile eggs and produced chickens. This is a distinct step further than hybrid and pure domestic in No. 1. The progeny of No. 2 experiment may be said to be a $\frac{3}{8}$ jungle and $\frac{5}{8}$ domestic. This experiment was repeated with several of the hybrid cockerels.

No. 3.—Hybrid Cock and Hybrid Hen.

This experiment was the crux of the whole problem before the experimenters. It was the experiment Mr. Mitford tried and failed to produce chicks. It was the experiment that led Darwin to conclude that the hybrids of *Gallus Stanleyii* were sterile. If the experimenters could only breed from this mating, the whole question would be settled at once and for ever, and the little Ceylon jungle fowl would have the honour of being acknowledged a parent stock.

The result so far has been a complete failure to produce chickens !

Some three or four hybrid cocks have been mated up in various runs with some four or five hybrid hens. Thus Mr. Mitford's one experiment has been multiplied four-fold. Each hen has laid several clutches of eggs, but so far no single chick has been produced. The eggs have been incubated by the hybrids themselves and also under other hens ; but no chicks. The large majority of the eggs have been infertile ; only in one or two instances have two or three of the eggs been addled, which points to the egg having been fertilized.

In some of these experimental runs the cock has been seen to tread the hens, and yet the eggs were infertile. In the Queensdown run the hybrid cock has never been seen to tread a hybrid hen ; it is not surprising therefore that all the eggs laid by the hybrids were infertile ; it would have been the same with eggs of any other neglected hen.

Some have suggested that since all the hybrids were produced by one pair of parents, and are therefore brothers and sisters, perhaps they may not be able to interbreed. But this would hardly be a serious objection to, or sufficient excuse for, infertility.

An interesting point worth recording about breeding from a hybrid cock is this. When a hybrid cock has the choice of mating up with either of the four following hens : (1) Domestic ; (2) ($\frac{1}{4}$ J + $\frac{3}{4}$ D) ; (3) hybrid ; (4) jungle ; he would take up with them in the order named. He would never look at any of the other three if he had a domestic hen to attend. The domestic hen is relatively a little wanton, so gentle, tame, and amenable ! If she be removed from the run the cock will then mate up with the next most domestic of the hens, *i.e.*, No. (2) ($\frac{1}{4}$ J + $\frac{3}{4}$ D). She is not so wild and will stand better than the remaining two. A hybrid cock has not yet been tried with only hybrid and jungle hens, but if he were and he did mate up, it would certainly be with the more domestic of the two, *i.e.*, the hybrid. The jungle hen is far too wild and timid in captivity and frightened even of a cock bird. Hence the difficulty of breeding from them with the domestic cock ; they are friendly

enough with him till he evinces any intention of treading them, and then they become beside themselves with terror!

Much time was wasted at the Queensdown run in first putting a domestic as well as a hybrid hen with the hybrid cock. His majesty of course neglected the hybrid for the domestic, and all the eggs of the former were of course infertile. Later the domestic hen was removed and another hybrid and one ($\frac{1}{4}$ J + $\frac{3}{4}$ D) hen were added. Once again the two hybrids were neglected while the cock mated up with ($\frac{1}{4}$ J + $\frac{3}{4}$ D) as stated in experiment No. 2, and produced chicks, whereas every batch of eggs laid by the two hybrids was infertile.

Only lately was the hybrid cock shut up to two hybrid hens alone. Since then they have both laid a clutch of eggs each and sat on them themselves, but all proved infertile. This is what may be called the first real test at Queensdown. The hybrid cockerel, it would appear, mates up with only one hen, just like the jungle parent.

No. 4.—Hybrid Hen and Domestic Cock.

An experiment is being tried by Mr. G. C. Bliss of Atgalla, in which a bantam cock is mated up with a hybrid hen. This domestic cock has often been seen to tread the hybrid hen, and she has laid several clutches of eggs, but so far they have all proved infertile.

No. 5.—Hybrid Hen and Jungle Cock.

At Hunasgeria Mr. Johnson put a hybrid pullet to his famous jungle cock (daughter to father), but as there were domestic hens in the run no attention was paid to this hybrid and her eggs were naturally infertile.

At Atgalla Mr. Bliss has a jungle cock mated up with a hybrid hen, but so far there have been no eggs, and the cock does not seem to notice the hen.

Two further experiments are worth mentioning.

It has already been stated (No. 1) that the hybrid cock mated with the domestic female produced chickens J $\frac{1}{4}$ + D $\frac{3}{4}$

In No. 2 we saw that a female of this blood had been mated back to the hybrid father and had produced chicks.

No. 6.—Male (J $\frac{1}{4}$ + D $\frac{3}{4}$) and Female (J $\frac{1}{4}$ + D $\frac{3}{4}$).

This pair of the same blood were mated together and produced chickens, *i.e.*, they will breed *inter se*.

No. 7.—Male (J $\frac{1}{4}$ + D $\frac{3}{4}$) and Domestic Hen.

The result of this mating was to produce chickens.

The chickens produced by the matings in No. 2, No. 6, and No. 7 may be stated to contain jungle and domestic blood in the following proportions respectively :—

No. 2 gives chicks = (J $\frac{3}{8}$ + D $\frac{5}{8}$).
No. 6 ,, = (J $\frac{2}{3}$ + D $\frac{6}{8}$).
No. 7 ,, = (J $\frac{1}{8}$ + D $\frac{7}{8}$).

It will, in conclusion, be observed that, whereas the hybrid cockerels have been fertile with the domestic and with the $\frac{3}{4}$ domestic hens, all the hybrid hens have been apparently sterile.

It has been therefore asked, Can the hybrid hens be sterile although the hybrid cocks are fertile ? Does such a condition obtain in breeding other birds or animals ?

No attempt has been made to demonstrate Mendel's law, the experimenters being ignorant of its exact nature. Doubtless many very interesting points bearing on this subject have passed entirely unnoticed and unrecorded.

The main object of the present experiments has been to investigate the sterility or fertility of the hybrids. The partially negative results so far obtained can hardly be said to finally settle the question. Experiments on a more extended scale are required. The present experiments have nevertheless added somewhat to the meagre data upon which the question of sterility of the hybrids was based. It is for others to state whether the results obtained so far in any way modify, confirm, or refute the accepted opinion that "this species then may in all probability be rejected as one of the primitive stocks of domestic fowl."

These experiments are greatly crippled for want of funds. The cost of putting up several suitable runs by any one experimenter is prohibitive, and many who are keenly interested in the experiments are deterred from undertaking them on the score of expense and want of ground space.

The accompanying diagram gives at a glance the various experiments and their results up to date (June 1, 1906).

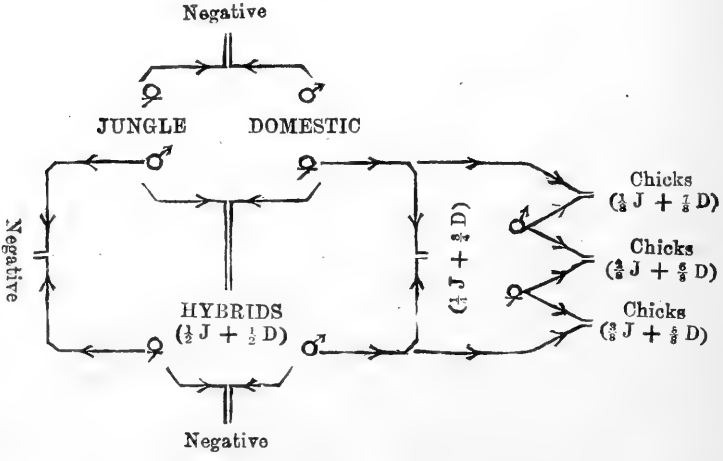
It will be seen that the jungle and domestic mating is the starting or centre point.

The mating of the domestic male with jungle female gives a negative result. That of the jungle male and domestic female gives the hybrids, males and females. The hybrid female mated back to the jungle cock gives negative results. The mating of hybrid with hybrid shows negative results.

The mating of the hybrid male back with the domestic parent gives males and females, which may be called hybrid-domestic (or $\frac{1}{4}$ J + $\frac{3}{4}$ D). The female of this, mated back to the hybrid

male, gives male and female progeny; and the male $\frac{1}{4}$ J + $\frac{3}{4}$ D mated back with the domestic female has produced chicks; and further the male and female $\frac{1}{4}$ J + $\frac{3}{4}$ D have bred *inter se* and produced chicks.

A Summary in Diagram of the Ceylon Jungle Fowl Experiments, June 1, 1906:—



THE LANKESVARA GOLD COIN.

By C. M. FERNANDO, M.A., LL.M. (Cantab.).

THIS coin is so called because of the fact that it bears upon it, in Nagari characters, the legend "Sri Lankesvara." "Sri" is an honorific word applied to royalty and the priesthood "Lankesvara" is compounded of the two words "Lanka" and "Isvara," and signifies "the Lord of Lanka." There are five different types of this coin in the Colombo Museum. These and the two coins of Parakrama Bahu are figured in the plates appended to this article.*

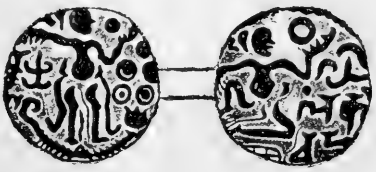


Fig. 1.—Sri Lankesvara Type.

On the obverse of the Lankesvara coin is a standing figure of the king. The two curved lines on either side of the legs depict the folds of the "dhoti," or cloth in which he is clad. What appears on the head to be a sort of "conical cap," as described by Rhys-Davids,† is in fact the "konde," or knot of hair. The konde has

Fig. 2.—Sri Lankesvara Type.

from the earliest times been a distinctive feature of the Sinhalese race, and has been so mentioned by ancient writers. Ptolemy speaks of the great length of hair worn by the people of Taprobane.

* Prepared from copies made by Mr. F. P. Kandappa, Draughtsman of the Colombo Museum.

† Numismata Orientalia, Part VI., p. 25.

Agatheremus (circa 272 A. D.) gives a detailed description of their mode of dressing the hair. "The men," he says, "who inhabit Ceylon allow their hair an unlimited growth, and bind it on the crown of their heads after the manner of women."*

Fig. 3.—Sri Lankesvara Type.

With his right hand he holds the sceptre of royalty ("jayakonte"), the emblem of his power.† To the left or innerside of the sceptre is a figure which I take to be another royal emblem, the "cámara,"‡ or flapper used to drive away flies from the royal presence.

The king stands on a lotus stalk terminating in figures 1, 2, and 4 with a flower. The left arm is bent downwards in figure 3. In the rest it is turned upwards, and in figures 2 and 4 holds a lotus flower, while in figures 1 and 5 it holds a circular object, which I believe to be the "chakra" or "discus," denoting universal dominion. Underneath the left arm are circular dots, which may be meant to depict the varying phases of the moon.

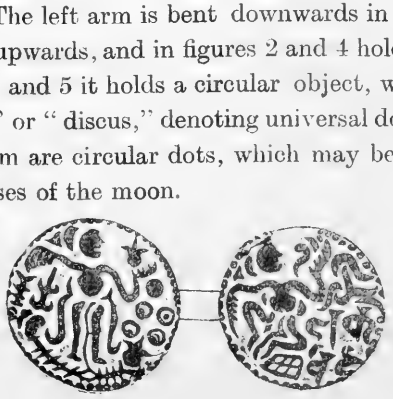


Fig. 4.—Sri Lankesvara Type.

On the reverse is the figure of the king in a rather uncomfortable sedent attitude. The parallel lines below indicate the throne. In figures 1 and 5 the left hand holds the "chakra," and in the other figures a lotus flower. To the right of the figure is the legend "Sri Lankesvara"§ (His Majesty the Lord of Lanka).

* "Τους Κατοικοῦντας αὐτην ἀνδρας μαλλοῖς ἀναδεσκαι τας κεφαλλας." Agathemerus Geogr., Lib., I., ch. VI.

Also, the *Mahawansa* says of Prakrama Bahu the Great: "Thereupon he forthwith fastened his hair-knot firmly, and wrapped himself closely in the blanket that he had girded himself with," &c. (Wijesinha's *Mahawansa*, Part II., p. 137.

† Of Duttagamini (161 to 137 B. C.) the *Mahawansa* says: "The royal suite, who were the sceptre bearers, in like manner deposited in an erect position, on the site of the (future) dagoba of that name, the imperial sceptre." (Wijesinha's *Mahawansa*, Part I., p. 102.)

‡ "A yak's tail, used as a whisk to drive away flies; it is one of the insignia of royalty." (Childers's Pali Dictionary.)

§ The letter "ra" is omitted in all the specimens for want of space.

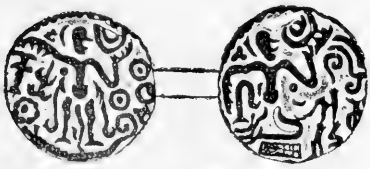


Fig. 5.—Sri Lankesvara Type.

Rhys-Davids has identified this coin as belonging to Parakrama the Great, who reigned at Polonnaruwa from 1164 to 1197 A.D. I venture to hold a different view. Figure 6 is the lion coin of that king (copper), and figure 7 is his copper "massa." Each of them bears the legend "Sri Parakrama Bahu," and not "Sri Lankesvara," and on each the figure of the king is different in detail from that on the Lankesvara coin.

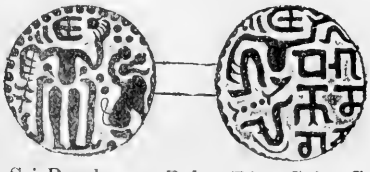


Fig. 6.—Sri Parakrama Bahu (Lion Coin, Copper).

The face consists of three lines with a curve at the back, described by Prinsep as "altogether unique in the history of perverted art." The characters of the legend are better formed and less archaic than those of the "Sri Lankesvara." The Lankesvara coin would thus appear to be anterior to the period of the Great Parakrama. The Pali equivalent of Lankesvara, "Lankissara," is applied in the *Mahavansa* to Vijaya Bahu I. (1065 to 1120 A. D.). The coin was

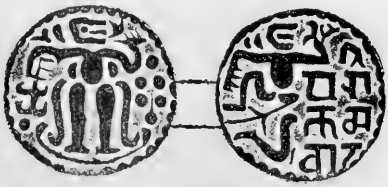


Fig. 7.—Sri Parakrama Bahu (Copper Massa).

very probably issued by that king. True it is that the word is applied to two earlier kings as well, Mahasena (277–304 A.D.) and to his successor Meghavarna; but the Nagari characters on the coin are of a period much later than that of these two kings. The long reign of Vijaya Bahu I., lasting as it did for over half a century, would have necessitated more than one issue of his money, which very probably accounts for the different types now extant. At any rate one thing is tolerably clear: the Lankesvara coin is not to be attributed to Parakrama Bahu I.

NOTES.

1. *Behaviour of Toads when confronted by a Snake.*—I was much interested in Mr. E. E. Green's note on the "Curious action of a toad when confronted by a snake" (*Spolia Zeylanica*, vol. III., Part XI. January, 1906, p. 196), since my colleague Mr. S. A. Heron and I once witnessed precisely similar behaviour on the part of toads towards a snake, although the species were different. In this case the actors were an English ringed snake (*Tropidonotus natrix*, Linn.) and three common toads (*Bufo vulgaris*, Laurenti), and the comedy was performed on the floor of an English greenhouse. The behaviour of the toads when confronted with the snake was exactly as described by Mr. Green, although, with its usual reluctance to feed in public, the snake made no attempt to attack them. The appearance of the toads was certainly most grotesque, and there is little wonder that a snake is disconcerted by the performance, which, as remarked by Mr. Green, is apparently due to an inherited instinct. In the case of English toads, at any rate, very many individuals in all probability pass their lives without ever seeing a snake.

I venture to think that the inflation of the abdomen, and perhaps also the tiptoe position, is due to a widespread instinct, which prompts a small and comparatively defenceless animal, when in the presence of a recognized or potential enemy, to make itself *as large as possible*. Many instances of this might be quoted, but the expansion of a cobra's hood, the behaviour of a half-tame owl when approached, and the action of a cat in the presence of a strange dog, will suffice as illustrations.

ERNEST E. AUSTEN.

British Museum (Natural History),
Cromwell Road, London, S.W.,
April 4, 1906.

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2. *Notes on the Ceylon Honey Bee.*—It is well known that the Ceylon honey bee (*Apis indica*) depends largely for its hive requirements on the cocoanut palm, but the "toddy-pot" suspended from the end of the undeveloped inflorescence in the process of extracting

toddy has a great attraction for them, and many get drowned in the sweet juice. A gentleman who has some experience of bee-keeping has come to the conclusion that only some of the hive inhabitants are addicted to the use of the fermenting liquid, a fact he is said to have discovered by marking the drunken bees with a dot of paint and noting the intoxicated condition of some who escape drowning and return to the hive. Whether there were sufficient data to warrant such a conclusion I am not prepared to say; but observations made in India corroborate the statement that the honey bee is particularly fond of toddy from the cocoanut palm and probably from other palms as well.

The bee has many enemies.

Geckos either watch for them on the alighting board or enter into the hive for a meal; garden lizards ("blood-suckers") take up a position near the hive and snap up any bees coming their way; spiders spin webs and trap bees, but sometimes also enter the hive; cockroaches are common in hives and appear to attack the combs; ants as a rule go after honey, but I have seen a party of red ants attempting to attack and capture bees; the bee moth and wax moth are not unknown. Mr. A. P. Goonetilleke of Veyangoda, has been greatly troubled with hornets raiding his hives. They kill the bees but do not appear to care for the honey. Mr. Goonetilleke informs me that the birds known as kawda, redihora, and polkichcha attack bees on the wing.

C. DRIEBERG.

Colombo, March 26, 1906.

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3. *Scorpion Stings.*—In reply to Mr. Green's request in his note on this subject in the last issue of this journal I write to say that I have experience of the sting of the small gray scorpion, and do not think it any more severe than that of our indigenous honey bee (*Apis indica*). The native remedy for the sting is a mixture of lime juice and slaked lime (the latter in the form of "chunam" used for betel-chewing).

"Eha" (E. H. Aitken) in his charming book, "The Tribes of my Frontier," referring to the scorpion as a superfluous enormity which cannot justify its existence, mentions that a drop of strong ammonia is an almost instant cure. I have found a saturated solution of salt as efficacious in the case of bee stings.

C. DRIEBERG.

Colombo, March 21, 1906.

4. *Colour adaptation to surroundings.*—On most tea estates up-country in Ceylon there are now numbers of large Dadap trees growing, the result of planting for the last twenty years. These trees are now visited in the day time by flocks of little lorikeets, coloured green with red spots, which cluster amongst the foliage and feed off the scarlet blossoms. The similarity of the colourings of the birds to those of the leaves and flowers of the Dadap trees is very remarkable, and the shades blend so harmoniously that when the former are at rest on the branches of a leafy tree it is almost impossible to detect their presence. This looks like a case of colour adaptation to surroundings so often observable in nature. Perhaps during your travels up-country you may have noticed it yourself. If not, I think it would be an interesting matter to look into.

S. E. TENCH.

6, Barons' Court Chambers, London, W.,
March 23, 1906.

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5. *The word "Boss."*—The derivation of this term, which is constantly applied in Ceylon to master craftsmen such as carpenters, blacksmiths, and others, forms the subject of a letter to the *Spectator* of 21st April, 1906, from Mr. Ernest H. S. Schwarz, of Rhodes University College, Grahamstown, South Africa.

The author of the letter referred to says :—

"In South Africa the term "baas" is commonly supposed to be the same, and the Hottentots call the head of the family "Ou baas," or old boss, and the eldest son is the "Yong baas." "Ou baas," however, is a term of respect, and may be used in addressing a beardless youngster who is in a position of authority, and there are grounds for suspicion that the words have been taken over by the Dutch from an original native source. It is significant that Cicero ("De Nat. Deorum") states that the god Vulcan was called by the Egyptians "Obas," who was the son of Cellum. "Skelm," in Cape language, is the same as Burns's "skellum" ("Tam o' Shanter"), and indicates an unruly person,—Bacchus and his various synonyms, who in a sense was the father of all. It seems extravagantly far fetched to trace back the Hottentot's "Ou baas" to the Egyptian "Obas"; but I have so frequently come across classical customs among the natives of South Africa that to me the connection does not seem improbable. I have seen the wailing for the dead Adonis

among the Basutos performed as ceremoniously as among the ancient Greeks, while some of the folklore tales of this nation, given by Cassalis, can be paralleled, incident for incident, with some of the Greek tales, which in many instances were borrowed from the Egyptians. I should explain that I am thinking of the god Obas (Vulcan), not as the blacksmith of later mythology, but as the very essence of supreme being."

Apropos of the above it may be of some interest to know that among the minor relics of the Dutch occupation of Ceylon which are exhibited in the Colombo Museum, there is a silver heirloom plate upwards of six inches in diameter, the general shape square, with the angles elegantly scalloped, bearing the following inscription in Dutch, indicating that it was dedicated to the memory of one Nicolaas Kuyselaar, a master coppersmith, who died in Colombo on the 19th April, 1774 :—

Ter
Gedagtenis : Van den
Eersamen
Nicolaas Kuyselaar,
In Zyn Leven Baas der
Smits, en Kuypers ;
Gebooren te Stynbach,
Den 13 April, 1714, Overleeden
te Kolombo,
Den 19 April, 1774
Oud 60 Jaaren
En 6 daagen.

It may be added that the silver plate bearing the above inscription is the only example preserved in this Museum in which the word "Baas" (which has been anglicized or "americanized" into "boss") occurs.

ED., *S. Z.*

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6. *Flying-foxes* (*Pteropus medius*) *at Barberyn.*—Having lately been afforded an opportunity of landing on Barberyn island, of whose flying-foxes and crows Dr. Willey* has already given a most interesting account, I was enabled to make a few additional observations on these bats.

* Spol. Zeyl., Vol. II., Part V., p. 50.

Resting Habits.

In the day time "the bats may be seen suspended in rows from the midribs of the palm leaves." They invariably select very high trees, and usually congregate in colonies of about six to ten on a tree, several such trees being together. Occasionally, they are to be seen on twigs and slender branches of other trees, but show a distinct partiality for cocos—mainly, I think, because these are higher and because the bare stem renders it more difficult for any enemy to approach unseen. These bats are very wary, and all in the vicinity take to flight when disturbed in any way, as by firing a gun. They are extremely tenacious of life and very difficult to kill.

Sexual Gregariousness.

It is well known that amongst bats in general the species are social and gregarious, but that the two sexes do not, as a rule, intermingle, and only come together at the nuptial season. At other times they live apart, and sometimes at considerable distances, so that in a large colony of a given species not a single individual of the female sex may be found, while in another the females will abound and not a male occur. This colony of flying foxes at Barberyn appears to be entirely composed of males. Four specimens were shot and all proved to be males, nor were any females or young observed. Dr. Willey refers to a similar colony on islands in the Bentota river, and it would be interesting to ascertain the sex of the individuals of which it is composed, and, if a female colony, whether it is entirely mutually complemental to the colony at Barberyn.

External Parasites.

The specimens shot were obtained with a view to examination for any peculiar fleas, but none were found. A large and very active bat-tick, however, was common, running freely over the body and wings; it is apparently a species of *Nycteribia*, a very remarkable apterous genus of parasitic Diptera. None of the flying foxes shot were free from these ticks, usually about half a dozen being present, but in one case only one adult specimen and one very immature. These parasites seem a great source of annoyance, the bats being seen often to scratch themselves as they hang on the trees.

Preference for Islands.

The habit of resting by day on islands, wherever these are accessible, seems to be general amongst the species of this genus. Keller*

* Keller, "Madagascar, Mauritius, and other East African Islands," p. 40.

says ;—"They especially haunt the coast region (of Madagascar), and spend the whole day clinging fast by the claws to the branches of the large trees on the lonely islands. At dusk they set forth for the places on the coast and plunder the fruit trees." And again* :—"Further out to sea (from Nossi-be) one perceives Tany Kely, an uninhabited islet which serves as a safe asylum for the large bats." In both these cases, *Pteropus Edwardsii* is the species referred to. It need hardly be pointed out that this partiality for islands is potent as a protection against enemies such as snakes and carnivorous mammals. There appear to be no snakes in Barberyn except a small *Dendrophis*.

T. BAINBRIGGE FLETCHER.

H. M. S. "Sealark," March 12, 1906.

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* *l. c.*, p. 155.

THE SCALY WINGED COPEOGNATHA (*Monograph of the Amphientomidæ, Lepidopsocidæ, and Lepidillidæ in relation to their Morphology and Taxonomy*).

By Dr. GÜNTHER ENDERLEIN.

(*Stettin.*)

With Plates A–G and six text figures.

CONTENTS.

Introduction.

In India, the Wonderland of Antiquity, there may yet remain many a secret unrecognized and unsuspected. It is my good fortune to raise the curtain upon an admirable nature-play ; minute insects, in appearance resembling microlepidoptera and not second to these in elegance and beauty of tint of the scaly covering, and yet only simple* "woodlice," a series of forms of the most varied description, of which only scanty fragments have hitherto been reported upon, here enjoy their obscure existence.

I am indebted to Mr. E. Ernest Green, the Government Entomologist at Peradeniya, Ceylon, for the opportunity of examining a rich collection of these exquisite animals from Ceylon. Doubtless numerous other species will still be found in the Indian Region, and the specimens which have occasionally reached my hands from the tropical regions of other parts of the world only indicate what a wealth of forms may yet be expected.

For a long time I had contemplated a monographic investigation of the scale-bearing Copeognatha, so that I gladly seized the opportunity to realize this idea, the more so because the abundant material from Ceylon put me into a position to finally establish and accurately illustrate a series of types described by Hagen from Ceylon in 1858 and 1859.

My hearty thanks are due to my friend and esteemed colleague, Professor F. Karsch, since I have only been able to carry this work through by the use, at home, of his excellent Zeiss-microscope.

In the following pages the morphological details will be found under the several families.

Preservation and Preparation.

For the preservation of scaly Copeognatha and of scaly insects in general the use of alcohol or of other fluids is in no case to be recommended, because the scales are mostly detached in the fluid and the design of the scale-covering can therefore no longer be recognized.

The scale-bearing Copeognatha are best preserved dry, and should be mounted upon minute needles of hard nickel and fixed on cubes of pith or better still upon small cardboard slips, the so-called

* The term 'woodlice'—as used by Dr. Enderlein—must not be confused with the crustacean animals popularly known by that name in England. The subjects of this paper are true insects, belonging to a family of which the commoner species are recognized in England by the name 'booklice.'

minimal labels [Minutienklebzettel], according to the system of Ortner, Vienna. Morphological details can be studied in examples which have been softened in caustic potash, so that, on the whole, alcoholic material can be dispensed with. Before softening a unique specimen a precise description of it must be provided. Above all, the wings should be carefully removed before the softening process ; one pair should be preserved dry between two cover-glasses rimmed with wax ; the other pair can, if necessary, serve for a Canada balsam preparation.

As I have indicated on a former occasion* and then again, in greater detail, later,† the method of softening is as follows :—

The insect is transferred carefully into a mixture of one part of moderately strong caustic potash and about 8–10 parts of water ; (winged insects after removal of the wings) ; except when dealing with very delicate animals, in which case the solution of caustic potash should be weaker. According to size and delicacy of the object it remains from ten minutes to several hours in the fluid, until it recovers approximately the natural form ; then it is transferred to water, where it must be watched since it now begins to swell. The larger air-bubbles are next carefully removed with a fine brush, and eventually the object is again placed in the dilute caustic potash. Here it can remain, at convenience, a longer or a shorter time ; even delicate examples can be left in the fluid for several days if the caustic potash is not too strong.

If the object presents black and dark-coloured chitin, it is often necessary to leave it in the solution for a long time in order to dissipate the pigment completely.

Finally, after the object has been washed out with water, it is transferred gradually into alcohol, where the smaller air bubbles can be easily removed. The animal can now be preserved in 96 per cent. alcohol, and it retains perfectly the natural form which it had regained in the caustic potash. If a permanent microscopic preparation is desired, the contents of the body should be removed as far as possible by pressure with a fine brush, and the object having been properly orientated, is treated first with absolute alcohol, then with cedar oil, and finally mounted in Canada balsam. Cedar oil is to be preferred to clove oil, xylol, or benzol because the diffusion of fluids takes place much slower and consequently shrinkages rarely occur.

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* Günther Enderlein. Eine Methode, kleine getrocknete Insecten für mikroskopische Untersuchung vorzubereiten in Zool. Anz. Bd. 27, 1904, pp. 479–480.

† Enderlein, Monographie der Coniopterygiden, Zool. Jahrb. Syst. Bd. 23, 1906 (pp. 173–242), see pp. 174–176.

When however the chitinous cuticle is very thin, it is impossible to avoid shrinkage if the object is mounted in Canada balsam; in such cases it should be transferred from the water into glycerin.

For permanent glycerin preparations the following is the best method :—The cover-glass, over which no glycerin must be allowed to escape, is fastened to the slide by means of a rim of wax which is applied by a wax taper or wax match which has been lighted and immediately extinguished ; the wax border can then be covered over with Canada balsam or gold size.

Teasing up the object with needles can only be effected successfully in Canada balsam or glycerin.

In dealing with delicate objects, the dilute caustic potash should not be heated, as the chitin is liable to change to a tenacious substance which will cling to the needles used in the preparation.

Geographical Distribution.

The Amphientomidæ, Lepidopsocidæ, and Lepidillidæ belong almost exclusively to the Tropics. Only two species occur in the sub-tropical region, namely, an Amphientomid, *Stimulopalpus japonicus*, nov, gen., nov. spec., in Japan, and one Lepidillid, *Lepidilla Kelloggi*, Rib., in California. One species only occurs in the Temperate zone, namely, *Echmepteryx Hageni*, Pack., in the United States.

The three families contain together nineteen genera; of these, three were described by Hagen (1859–1866), one by Ribaga (1905). one by Aaron (1886), and fourteen by me.

Up to the present, forty-four species belonging to these nineteen genera are known, of which one was described by Packard, one by Ribaga, nine by Hagen, and thirty-three by me. Of the last, twenty-two species are established in the present work.

Table of the Recent and Fossil Scaly Copeognatha.

Fam. AMPHIENTOMIDÆ. Enderl. 1903.

Sub-fam. Tineomorphinæ, m.

I.—*Tineomorpha*, nov. gen.

1. *Greeniana*, n. sp. Ceylon.

II.—*Cymatopsocus*, Enderl. 1903.

2. *opalinus*, Enderl. 1903. Further India.

Sub-fam. Amphientominæ, Enderl. 1903.

III.—*Syllysis*, Hag. 1866,

3. *caudata*, Hag. Ceylon.
4. *erato*, n. sp. Ceylon.
5. *rilusamhara*, n. sp. Ceylon.

IV.—*Amphientomum*, Hag. 1856.

6. *paradoxum*, Pict. Hag., 1856. in amber.
7. *leptolepis*, Enderl., 1905, in amber.

8. *colpolepis*, Enderl., 1905, in amber.

V.—*Paramphientomum*, n. g.

9. *Nietneri*, n. sp. Ceylon.

VI.—*Stimulopalpus*, n. g.

10. *japonicus*, n. sp. Japan.

VII.—*Seopsis*, n. g.

11. *vasantasena*, n. sp. Ceylon.
12. *superba* (Hag., 1865). Ceylon.
13. *metallops*, n. sp. Ceylon

VIII.—*Hemiseopsis*, n. g.

14. *Fülleborni*, Enderl. 1902. East Africa.

IX.—*Stigmatopathus*, Enderl. 1903.

15. *Horváthi*, Enderl. Further India.

Fam. LEPIDOPSOCIDÆ, Enderl. 1903.

Sub-fam. PERIENTOMINÆ, Enderl. 1903.

X.—*Soa*, Enderl. 1904.

16. *Dahliana*, Enderl. 1904. Bismark Archipelago.
17. *flaviterminata*, n. sp. Ceylon.

XI.—*Perientomum* Hag. 1865.

18. *trichopteryx*, Hag. 1859. Ceylon.
19. *chrysargyrium*, n. sp. Ceylon.
20. *gregarium*, Hag. 1865. Ceylon
21. *Greeni*, n. sp. Ceylon.
22. *morosum*, Hag. 1865. Ceylon.
23. *triste*, Hag. 1865. Ceylon.
24. *ceylonicum*, n. sp. Ceylon.
25. *argentatum*, n. sp. Ceylon.
26. *acutipenne*, n. sp. Ceylon.
27. *incultum*, Hag. 1865. Indian Copal.

XII.—*Lepium*, n. g.

28. *chrysochlorum*, n. sp. India.
29. *luridum*, n. sp. Ceylon.

XIII.—*Nepticulomima*, n. g.

30. *Sakuntala*, n. sp. Ceylon.
31. *Essigkeana*, n. sp. Ceylon.
32. *Hösemanni*, Enderl. 1903. Cameroons.
33. *brasiliensis*, Enderl. 1906. Brazil.
34. *Birói ana*, Enderl. 1903. New Guinea.
35. *chalcomelas*, n. sp. Ceylon.
36. *mortua* (Hag. 1865) Zanzibar Copal.

Sub-fam. LEPIDOPSOCINÆ. Enderl. 1903.

XIV.—*Echmepteryx*, Aaron. 1886.

37. *Hageni* (Packard, 1870). North America.
38. *mihara*, n. sp. Ceylon.
39. *sericea*, n. sp. Ceylon.

XV.—*Lepidopsocus*, Enderl. 1903.

40. *Nepticulides*, Enderl. 1903. Further India.

Sub-fam. ECHINOPSOCINÆ, m.

XVI.—*Echinopsocus*, Enderl. 1903.

41. *erinaceus*, Enderl. 1903. New Guinea.

XVII.—*Scolopama*, n. g.

42. *halterata*, n. sp. Ceylon.

Fam. LEPIDILLIDÆ (Ribaga, 1905).

XVIII.—*Lepidilla*, Rib. 1905.

43. *Kelloggi*, Rib. 1905. California.

XIX.—*Lepolepis*, n. g.

44. *ceylonica*, n. sp. Ceylon.

TABLE OF COMPARISON OF THE AMPHIENTOMIDÆ, LEPIDOPSOCIDÆ, AND LEPIDILLIDÆ.

	AMPHIENTOMIDÆ.	LEPIDOPSOCIDÆ.	LEPIDILLIDÆ.
Head	Glabrous or nearly so	With long hairs generally close-set	With long and shaggy hairs
Occipital margin	Sharp	Sharp	Sharp
Eyes	Glabrous (except in Tineomorphinæ)	Pubescent	In front or also in the middle finely pubescent
Ocelli	0, 2 or 3	0, or 3	0
Joints of antennæ	13	About 21–47	More than 50
Inner lobe of maxilla	Spatulate, irregularly toothed	With 3 apical points	With 3 apical points
Terminal joint of the maxillary palp	Long and slender	Short, strongly widened, truncate at the end, like an axe	Short, strongly widened, truncate at the end, like an axe
Maxillary palp-organ	In the form of a sense-papilla; in the Tineomorphinæ a long sense-hair	In the form of a short sense-papilla	In the form of a short sense-papilla
Prothorax	Small, concealed below the mesothorax	Large and broad, visible from above	Large and broad, visible from above
Scales on the legs	Femora tibiæ and first tarsal joint	Femora and tibiæ	Ends of the femora and bases of the tibiæ
Teeth on the claws	1–2; also about 1–10 fine hair-like or thorn-like denticulations	1, rarely traces of more, without hair-like denticulations	1
Hind-tibiæ (over the entire length)	Beset with very short and fine spur-like thorns	With a great number of unusually long and strong bristles on the outer side, some of them nearly half the length of the tibia	With numerous long and strong bristles; middle tibiæ also with long and strong bristles
Thorn-shaped anal appendages on the lateral valves of the telson	Absent	Present	Present
Fore wings	With veins; on the outer side usually rounded, rarely drawn out to a point at the front edge; sometimes with a tail-like appendage in the middle of the outer margin	With veins; usually more or less strongly acuminate, sometimes with long thin apex; only in *Soa*, Enderl., is the outer margin rounded.	Small, scale-like; without veins

	Amphientomidæ.	Lepidopsocidæ.	Lepidillidæ.
Scales of fore wing (excluding the marginal scales)	Equal; in the Tineomorphinæ only are there ground-scales and covering scales	Ground-scales and covering scales; or asymmetrically knife-shaped	Equal
Between the scales of the fore wing.	Numerous very fine and short hairs	No fine and short hairs but only scattered long and strong hair-like scales	Neither hairs nor hair-like scales
Marginal vein ..	Scarcely perceptible; without cross rows of hair-cupules; chiefly scaled	Sharply demarcated; with cross rows of projecting round hair-cupules; chiefly hairy	Absent
Analis and Axillaris	End in one point (Nodulus) as in all other Copeognatha	Never end in one point	—
2. Axillaris ..	With the exception of *Stigmatopathus*, Enderl., constantly present	Absent	—
Very long and strong bristles (macrochætæ), which stand vertically upon the marginal zone (especially the subcostal cell) and on the veins	Absent	Present	—
Hind wings ..	Front and outer border scaly, as well as the apical membrane usually; in the Tineomorphinæ almost the whole surface	Without scales, only pubescent; in the Echinopsocinæ they are strongly reduced or absent	Absent
Media ..	Simple, only in the Tineomorphinæ forked	Two distinct branches	—
Radius and median trunk	Widely separated; a large cell intervening	Coalesced or only an extremely narrow and long cell between	—
Radial ramus and Media	United by a cross vein which serves as the basis of both	Fused at the base r_1 therefore appears to arise from the media or the radial ramus	—

Fam. AMPHIENTOMIDÆ.

[Enderlein. Ann. Mus. Nat. Hung., Bd. I, 1903, p. 206.]

Head, large, hairless, or with very short hairs; eyes and clypeus very slightly projecting. Occiput very steeply declining and sharp-edged; the margin somewhat rounded. Eyes moderately large, hairless, except in the Tineomorphinæ, where they are compactly and shortly pubescent.

The three ocelli of the Amphientominæ are rather far apart, but always form a small triangle; the anterior ocellus generally smaller (only larger in *Seopsis metallops*, n. sp.); the ocelli are sometimes absent (*Stigmatopathus*, Enderl.); the Tineomorphinæ have only two ocelli which lie more or less close in front of the border of the compound eyes. Maxillary palp 4-jointed, the first joint very short, the last long and slender. Inner lobe of the maxilla strongly widened at the end and very irregularly notched and flatly dentate. Organ of the maxillary palp, in the Amphientominæ, in the form of a short sense-club; in the Tineomorphinæ it has the form of a remarkably long sense-hair on the inner side of the second joint of the palp. Labial palp 2-jointed, but the two joints grow to a large roundish disc-like structure close together (as figured in the case of *Cymatopsocus*, Enderl., in Ann. Mus. Nat. Hung., Bd. I, 1903. Plate XII., fig. 56 *i*).

Flagellum of the antenna thin to very thin, rather closely beset with long to very long hairs. Antenna short, two-thirds to three-quarters the length of the fore wing. The number of the long antennary joints is in all cases, recent and fossil, thirteen. Hagen (Ent. Zeit. Stettin, 1882, p. 268) states that the antennæ of *Amphientomun paradoxum*, Hag., from amber, are 15-jointed. I have however been able to convince myself by examination of Hagen's material that the species which occur preserved in amber have also only 13 antennary joints (*cf.* Enderlin, *l.c.*, 1905, p. 576). In consequence of the extraordinary and unusual length of the very thin antennary joints it is very difficult to count them with certainty in the amber.

Prothorax small, compressed below the mesothorax, and not visible from above; mesonotum beset with scales. Femora, tibiæ, and first tarsal joint beset with slender scales. Hind tibiæ with very short and fine spur-like thorns scattered along the entire length. Hinder tarsal joints with a series of *ctenidiobothria* (fig. 123) on the inner side. Tarsi 3-jointed. Claws with one tooth before the apex (*Stimulopalpus*, Enderl.; *Seopsis*, Enderl.; *Stigmatopathus*, Enderl.); or with two teeth (*Amphientomum*, Hag., 1859.

Paramphientomum, n. g., *Syllysis*, Hag., and in the Tineomorphinæ); between the tooth or teeth and the basal angle a row of about 4–6 or more (about 10 in the Tineomorphinæ), bristle-like, partly expanded or almost tooth-like chitinous processes, like the teeth of a comb; these are more or less strongly inclined towards the apex.

Fore wing normally rounded on the outer side, sinuous (*Cymaopsocus*, Enderl., 1903), or the apex is more or less produced, or in front of the middle of the outer border there may be a thin tail-like process. Subcosta moderately long, its distal portion shutting off the pterostigma at the base may be absent (*Seopsis Fülleborni*, Enderl., 1902, and *Paramphientomum Nietneri*, n. sp.); according to the size of the pterostigma, it is more or less long.

R_2, straight; the triangular pterostigma may be narrow and long, or broad and short, sometimes very small; it is cell-like, not strongly chitinised but membranous. The distance between the place of branching from the radial ramus and the pterostigma is long to very long. The stigma-sac is a more or less thickened spot on the lower side of r_1 in front of the pterostigma or at the base of the distal portion of the subcosta. Radial ramus united with the media by a short cross vein which meets the media inside of the three median branches or between the second and third median branch (Tineomorphinæ). Areola postica large to very large, usually elongate; cu_2, more or less long; analis (*an*) and *axillaris* (ax_1) constantly end in one point called the nodulus; there are two axillary veins.

Hind wings:—In *Amphientomum* and in the Tineomorphinæ, r_1 terminates near the end of r_{2+3} at the anterior border, but is absent from all other recent forms (except the Tineomorphinæ) where the radius ends at the point of ramification of the radial ramus. The basal portion of the radial ramus, which appears as a cross vein may, as well in fossil (*Amphientomum*) as in recent forms (*Seopsis*, n. g.), be present or absent; in the latter case it is frequently feebly indicated. Media and cubitus simple, the latter forked in the Tineomorphinæ, axillaris rather long. Radial ramus and media united by a cross vein which serves as the base of both.

Fore and hind wings without prominent marginal vein. Membrane of fore wing closely scaled; between the scales numerous very fine and short hairs (absent from the Lepidopsocidæ). Outer margin of hind wing scaled and at the same time bearing long hairs, generally a more or less broad zone at the outer border also scaled (in *Amphientomum metallops*, n. sp. alone the scaling of the membrane is completely absent); hinder margin with very long hairs;

in the Tineomorphinæ the scaly zone is very broad and extends along the entire hind border.

The scales of the fore wing may have parallel sides, or the latter may converge towards the base; they are more or less slender, slightly curved at the end, generally truncate or emarginate, differing according to the species. Marginal scales slender to hair-like, thin and long, rounded at the end, directly truncate or more or less deeply bidentate. In the Tineomorphinæ the scales of the fore wing have become still further differentiated; in addition to the ground scales there are at various points still larger covering scales.

The scaleless *Empheriinæ* and *Psyllipsinæ*, which I formerly placed with the Amphientomidæ, constitute together a special family which I name the *Empheriidæ*. Perhaps the *Thylacinæ* (Enderlein, 1903) also belong to this family as a third sub-family, *cf.* page 77, footnote.

TABLE FOR THE DETERMINATION OF THE SUB-FAMILIES OF AMPHIENTOMIDÆ.

	TINEOMORPHINÆ.	AMPHIENTOMINÆ.
Cross vein between radial ramus and media in the fore wing	Discharging between m_2 and m_3.	Discharging basalwards from m_3.
Media in hind wing ..	Forked	Simple.
Eyes	Pubescent	Glabrous.
Ocelli	Two, immediately in front of the eyes	None or three, placed relatively close together.
Organ of maxillary palp	Long sense-hair	Short sense-club.
Scales of fore wing excluding the marginal scales	Ground-scales and cover-scales	Equal.
Scaling of hind wing..	Nearly the entire surface, front border and outer border	The membrane of the wing-apex (the latter being scaleless), the front margin and outer margin.

Sub-fam. TINEOMORPHINÆ.

TABLE FOR DETERMINATION OF THE GENERA OF TINEOMORPHINÆ.

Outer margin of the fore wings smooth; the ocellus lying in front of each eye nearly touches the border of the eye .. *Tineomorpha*, n. g.

(Type *T. Greeniana*, n. sp.).

Outer margin of the fore wings with two sinuous emarginations; the ocellus in front of each eye is farther removed from the eye-border than the length of its diameter .. .. *Cymatopsocus*, Enderl., 1903.

(Type *C. opalinus*, Enderl., 1903.

Tineomorpha, n. g.

Two ocelli close in front of the eye-borders, nearly touching the latter. Terminal joint of the maxillary palp long, not thickened at the end; organ of the maxillary palp not in the form of a sense-club but a long sense-hair (fig. 97 *sh*). Inner lobe of the maxilla (fig. 100) strongly expanded at the end, with strong flattened and blunt teeth. Eyes closely and shortly pubescent. Claws with two powerful teeth before the apex and behind these a row of 9–10 acute, very fine denticles curved backwards.

Wings (fig. 25 and 26) with smooth border, particularly the outer border is perfectly smooth, neither emarginate nor sinuous. The portion of the subcosta which shuts off the pterostigma at the base is clearly formed and long. The cross vein between media and radial ramus in the fore wing discharges between the points of insertion of the second and third median branches (m_2 and m_3). Two axillary veins (ax_1 and ax_2) in the fore wing.

Fore and hind wings scaly. Scales of the fore wing more or less long, round, and truncately bent at the end, or rounded; scales of two kinds, smaller ground-scales and larger cover-scales. Marginal scales slender, emarginate at the end. Scales of the hind wing slenderer, often emarginate in front; marginal scales very slender, at the hinder border hair-like.

The form of the scales agrees completely with the genus *Cymatopsocus*, Enderl., 1903.

One very large species from Ceylon.

Tineomorpha Greeniana, n. sp. (figs. 1, 25, 68, 94, 97, 100).

Head reddish brown, with close and flat silver gray pubescence. Occiput sharply declivous, rounded, somewhat concave. Suture of the vertex fine; suture very distinct between vertex and front, terminating laterally at the antennary groove which lies close in front of the eyes. The two ocelli relatively large, brown, nearly touching the borders of the eyes to the inner side of the antennary grooves. Front (forehead) rather long, flat. Clypeus moderately projecting. Upper lips fairly smooth, blackish-brown. Cheeks somewhat

expanded in a lobe-like manner, brownish yellow. Antennæ short, about two-thirds the length of the fore wing, 13-jointed, blackish gray, the two basal joints and the third and fourth joints reddish brown, the pubescence gray, oblique and moderately close; in the male compact, fairly erect and longer. Eyes closely and extraordinarily shortly pubescent, standing off somewhat laterally, in the male rather more so; temples displaced by the eyes. Inner lobe of the maxilla (fig. 100) strongly expanded at the end with strongly flattened and blunted teeth. Maxillary palp (fig. 94) blackish brown, apex of the terminal joint brownish yellow; third and especially the second joint with slender scales between the hairs, particularly at the outer side (fig. 97); the palpal organ of the second joint which is here developed as a sense-hair (fig. 97 *sh*) is shorter than half the length of the joint.

Mesothorax black above, covered with glistening straw-coloured scales. Parapsidal furrows very indistinct. Abdomen pale brownish, rather closely beset with silvery gray hairs; without scales. Legs brownish yellow, the brown colour as follows:—Anterior border of the coxæ, a broad diffused ring in the middle and the apex of the upper side of the femora, the tibiæ with exception of the base, the apex, and a ring before the centre, in the anterior and mid-tibiæ a small spot upon the upper side of the extreme base; the base of the first tarsal joints, as well as the second and third tarsal joints. The anterior femora are more strongly expanded than the rest.

Claws (fig. 68) large, slender; between the two powerful teeth before the apex, a smaller; between the inner angle and the first tooth a series of 9–10 acute, backwardly curved, very fine denticles.

Length of hind tibia $1\frac{1}{2}$ mm.; on the inner side six spurs, and in addition on the inner side at the end four spurs, on the outer side two spurs, all spurs without ctenidiobothria. The length of the first, second, and third joints of the posterior tarsi is 1·16 mm., 0·13 mm., and 0·15 mm. respectively, *i.e.*, in the approximate ratio $8\frac{1}{3} : \frac{4}{5} : 1$. The first posterior tarsal joint with 43 short and small ctenidiobothria. Femora and tibiæ beset throughout their whole length with narrow, truncate scales which are silvery on the clear areas, brown on the brown tract.

Fore wings dull straw colour to grayish white, marbled with labyrinthine design (fig. 1). Front margin with 8–9 strongly marked dark brown spots interrupted by clear spots. Veins brown.

Hind wings with exception of the centre rather closely scaled whitish gray to pale brownish, hind border densely pubescent. Membrane of the hind wing brightly iridescent green to red.

Membrane of the fore wing dull opaque grayish white. The remarkable opalisation of the wings of *Cymatopsocus opalinus*, Enderl., 1903, is quite absent here.

The veins (fig. 25) are explained in the diagnosis of the genus.

Length of fore wing $4\frac{3}{4}$–5 mm. Wing expanse 11–$11\frac{1}{2}$ mm.

Ceylon, Peradeniya, on tree-trunks. January, 1905, two males and one female. March, 1905, two females. Collected by Mr. E. Ernest Green.

var. *major* n. (fig. 26).

One male differs from the five specimens recorded above by its greater size. The colour is somewhat more whitish, but there are no further differences, so that it probably represents a second more highly developed generation.

Length of fore wing 5·6 mm.; wing expanse $12\frac{1}{2}$ mm.

Ceylon, Maskeliya; on the stem of a bamboo; April, 1905, one male. Collected by Mr. E. E. Green.

Cymatopsocus, Enderl. 1903.

[Ann. Mus. Nat. Hung. Bd. I., 1903, p. 314.]

Cymatop. opalinus, Enderl., 1903 (fig. 98).

[*l.c.* p. 315, fig. 56 *a–m.*]

The palpal organ of the second joint of the maxillary palp is—as in the preceding genus—developed not in the form of a sense-club but as a sense-hair (fig. 98 *sh.*). It reaches in this species a remarkable length, being longer than the second joint of the palp.

Further India.

Sub-fam. AMPHIENTOMINÆ.

[Enderlein. Ann. Mus. Nat. Hung. Bd. I., 1903, p. 207 and p. 310.]

TABLE FOR DETERMINATION OF THE GENERA OF AMPHIENTOMINÆ.

1. With 3 ocelli; 2 axillary veins in fore wing	2.
Without ocelli; 1 axillary vein in fore wing; r_1 and *sc* of the ptersotigma lie close together.	*Stigmatopathus*, Enderl., 1903.

Type :—*St. Horváthi*, Enderl., 1903.

2. Outer border more or less strongly acuminate in front or with a thin, more or less long and acute tail-like appendage in the middle ; claws with 2 teeth before the apex ; r_1 absent from hind wing .. .. *Syllysis*, Hag., 1865.

Type :—*S. caudata*, Hag., 1865.

Outer border quite rounded .. 3.

3. Claws with one tooth before the apex .. 5.
Claws with two teeth before apex .. 4.

4. R_1 present in hind wing (fossil in amber) *Amphientomum*, Hag., 1856.

Type :—*A. paradoxum*, Hag., 1887

R_1 absent from hind wing (recent) .. *Paramphientomum*, n. g.

Type :—*P. Nietneri*, n. sp.

5. R_1 present in hind wing (recent) .. *Hemiseopsis*, n. g.

Type :—H. *Fülleborni*, Enderl., 1902.

R_1 absent from hind wing (recent) .. 6.

6. Maxillary palp without spur, hind tibiæ with few spurs ; very small forms .. *Seopsis*, n. g.

Type :—*S. Vasantasena*, n. sp.

Second, third, and fourth joints of the maxillary palp with stout spurs ; hind tibia with numerous spurs ; very large species .. *Stimulopalpus* n. g.

Type :—*St. japonicus*, n. sp.

Syllysis, Hag., 1865.

[Hagen. Ent. Mo. Mag., Vol. II., 1865, p. 150 ; and Verh. Zool. Bot. Ges. Wien., 1866, p. 203.]

(Type :—*S. caudata*, Hag., 1865).

Occipital border sharp edged, the edge rounded. Front long ; antennæ thin and short ; three ocelli placed relatively close together. Terminal joint of the maxillary palp slender, not acute ; palpal organ of the second joint of the maxillary palp in the form of a sense-club. Claws with two teeth before the apex. Tarsi 3-jointed.

Outer border of the wings between the ends of m_1 and m_2 with an outgrowth (♂), which in the female is produced into a more or less long and acute tail-like process. It is remarkable that in this case the female is characterised in such a marked manner.

There is no pterostigma since the distal portion of the subcosta is lacking. Stigma sac distinct. Median branches very long. Areola postica elongated. Two axillary veins.

In the hind wing, *an* and *ax* end rather near to one another; media simple. In the fore wing between the scales are numerous very fine hairs.

Scales slender, sides nearly parallel, ends rounded (fig. 42). Marginal scales (fig. 42, *rs*) very slender, truncate at the end. Scales of the hind wing (fig. 43) very slender, with two long acuminations at the end, which become shorter towards the margin of the wing.

Three relatively large species from Ceylon.

It is thus established with certainty that this important genus does not belong to the Lepidopsocidæ (*cf.* Enderlin, 1903); it is, on the contrary, a typical Amphientomid.

TABLE FOR DETERMINATION OF THE SPECIES OF THE GENUS SYLLYSIS.

1. Fore wings with some broad silver cross bands, gold markings, and a large orange yellow or gold spot in the anterior half of the apical quadrant .. .. 2.
   Fore wings with numerous fine, sinuous, closely arranged golden cross-bands; over the front and vertex two broad dark brown longitudinal bands .. *ritusamhara*, n. sp.
2. Vertex with a broad black cross band between the eyes .. .. *caudata*, Hag., 1865.
   Vertex with two fine parallel dark brown cross bands between the eyes .. *erato*, n. sp.

Syllysis erato, n. sp. (figs. 2, 37, 38, 42, 43, 55, 95, 102).

Head whitish grayish yellow, glabrous. Across the vertex, uniting the eyes, are two narrow parallel dark brown bands, leaving an equally broad tract between them; the anterior band placed at the front margin of the vertex, runs through the two posterior ocelli and is feebly notched (concave forwards) in the middle; the hinder band is indistinctly concave forwards. Occipital border, sharp edged, the edge rounded, somewhat concave. Suture of vertex very fine, sometimes almost invisible; suture between vertex and front distinct. Front remarkably elongate and very flat. Clypeus relatively small

and unusually flat (only feebly convex), with three wide brown longitudinal streaks, which frequently coalesce, not quite reaching the hinder border and sometimes confined to the anterior half (in poor specimens not be seen). Cheeks lobe-like, expanded below with almost circular margin; at the point of junction with the forehead a diffuse brownish line. Antennæ brownish yellow, the two basal joints and the third joint pale grayish yellow, becoming darker towards the apex. Antennæ approximately half the length of the wing, in the male with close-set long hairs on all sides, in the female only thickly hairy forwards, beset behind sparsely with long hairs. Antennæ inserted close in front of the eye-border.

Ocelli small, reddish brown; interval between the posterior ocelli almost equal in length to the interval between them and the eye-borders.

Eyes smooth, dark brown, with darker bands, generally a golden sheen in the male, glabrous, very slightly convex; the borders are not angulately set off from the vertex, but the eyes pass quite flatly into the vertex; scarcely different in male and female. Temples quite ousted by the eyes.

Upper lip small, strongly retracted. Apical third of the second, the third, and fourth joint of the maxillary palp, pale brown; approximate ratio of the palpal joints as $\frac{1}{5} : 1\frac{2}{3} : 1 : 1\frac{1}{2}$ (fig. 95). Sense-club (fig. 95, *sk*) of the second joint of the maxillary palp short and stout. Inner lobe of the maxilla (fig. 102) with irregular, strongly flattened, and rounded teeth.

Thorax pale, brown-scaled above, with gold coloured scales at the sides. Abdomen, in spirit-specimens, very pale; diffuse grayish brown cross streaks at the segmental junctions; finely and moderately closely pubescent, without scales; apex of abdomen brown. Legs yellowish gray white; the brown colour is distributed as follows :—apex of the coxæ and on the underside of the femora, in each case, a spot in the middle, before the base and before the apex; the latter spot is very feeble in the mid legs and is generally absent from the hind legs; on the upperside of the femora the extreme border of the apex; the fore and mid tibiæ are annulated in the centre by two brown bands in such a manner that three approximately equal uncoloured tracts remain free; in the hind tibiæ these rings expand so that only the extreme apex and base and a narrow uncoloured ring at the end of the second third remain free; the three tarsal joints with the exception of a clear ring in the middle of each and except the extreme apex of the first joint.

Femora compressed, especially the expanded anterior pair. Claws (fig. 55) slender, apex moderately acute; between the two

stout teeth before the apex there is an indication of a minute blunt denticulation; between the base and the first tooth, on the inner side, a row of bristly hairs.

Hinder tibiæ 1·12 mm. long; outside with 3 spurs, inside with 7 spurs, in addition to the terminal spurs of which there are 4 inside and 2 outside; each spur with a ctenidiobothrium which exhibits the same structure as in the first posterior tarsal joint. The length of the first, second, and third hinder tarsal joints is 0·67 mm., 0·07 mm., and 0·09 mm., the ratio being as $7\frac{1}{2} : \frac{7}{9} : 1$. First joint of the posterior tarsus with about 25 ctenidiobothria, which are very broad and arcuate; the marginal bristles are fine hairs; along the arcuate margin there is a row of very small black pigmented points, with two terminal spurs.

Femora and tibiæ, in their whole length, beset with narrow silvery scales (coloured brown on the brown tracts), which are abruptly truncate behind.

Fore wing with a tail-like outgrowth at the outer margin between m^1 and m_2, which is short and rounded in the male (fig. 37), long and acuminate in the female (fig. 38).

The extraordinarily dense and differentiated scaling of the fore wing occasions an unusual likeness to the marking of a moth's wing, as can be seen from figure 2. The colouration is essentially as follows:—The ground colour is brown; four narrow silvery cross bands, which are acutely notched outwards in the middle, divide the wing into four quarters, the two first bands occurring close beside one another at the end of the first quarter, the third in the middle, the fourth approximately at the end of the third quarter. The posterior halves of the two first bands are golden, much reduced and interrupted, the first not reaching the fore margin; the third is interrupted in the middle, and is considerably wider in the posterior half; the fourth is golden in the posterior half, thin and linear, usually much diffused in the middle. The third and fourth bands are distinctly seamed with black brown in the anterior half; between them about 5 golden streaks run from the anterior margin, in front interrupted nearly equally by brown streaks which soon fuse and disappear behind (hardly $\frac{1}{4}$ of the wing breadth), only the most external of them runs into the angle of the notch of the fourth silver cross band. Between the posterior halves of the third and fourth bands occur irregular golden spots, here and there also silver scales. The anterior half of the outer quarter of the wing is occupied by a roundish reddish golden spot into which a prominent silvery wedge-shaped spot projects from the end of the fore margin, the base of the wedge lying upon the fore margin and its catheti

seamed with black. This seam proceeds inwards into a narrow wedge-shaped spot lying at the margin and is prolonged outwards into a seam at the outer margin which bends inwards at the caudate process and merges into the brown colour of the posterior half of the outer quarter of the wing, which is only interrupted by a roundish golden spot in its outer moiety, two silver marginal spots behind the latter, the inner of which becomes towards the inner side gradually golden, and by a narrow golden spot placed parallel to the end of the fourth cross band ; in the inner half occur scattered groups of silver scales and in front at the limit of the golden spot, a deep blackish brown longitudinal spot, which is bounded behind by a diffuse golden line. The scaling of the outer margin is yellowish golden ; the caudate process is silvery, its hinder margin black. The base of the wing is yellowish golden. The membrane is tinted pale brownish. Hind wing hyaline, apical angle with very slender scales ; ends of the veins and the analis beset with scales. Hind margin hairy ; veins and scales pale brownish. Venation and scaling of both wings are described in the diagnosis of the genus. Membrane of the hind wing intensely iridescent, green to red.

Length of fore wing in male 3 mm., in female 4 mm. ; expanse of wings in male 7 mm., in female 9 mm.

Ceylon. Peradeniya ; on tree trunks, February, 1905. Eighteen males (7 in alcohol) and five females (1 in alcohol) ; collected by Mr. E. E. Green.

Syllysis caudata, Hag. 1865.

Amphientomum caudatum, Nietner in litt. ; Hagen Ent. Mo. Mag., vol. II., 1865, p. 150.

Syllysis caudata, Hagen. Ent. Mo. Mag., vol. II., 1865, p. 151.

Syllysis caudata, Hagen. Verh. Zool. Bot. Ges. Wien, 1866, pp. 204, 210, and 219.

Syllysis caudata, Hag. Enderlein Ann. Mus. Nat. Hung. Bd I., 1903, p. 320.

Hagen, *loc cit.* :—

" Head bright yellow, with a broad black band between the eyes ; ocelli distant ; palpi grayish brown ; antennæ grayish brown, the three basal joints yellow ; thorax brown, bordered on each side and posteriorly with golden scales, brown in the middle ; abdomen black ; superior wings elongated, the apex prolonged into a point truncated posteriorly, brown, with the scales forming very pretty markings, viz., the base golden, with silvery bands, on the middle of the anterior margin a golden band between two silvery lines bordered with black ; at the apex an oblique comma-shaped silvery

mark bordered with black, behind this mark an orange spot partially encircling a black pupil, placed after the apical prolongation ; inferior wings hyaline, brown ; legs yellow, femora with two black rings nearly obsolete on the posterior pair, posterior tibiæ black with a yellow ring before the apex, first tarsal joint with two black rings, the two following brown.

Long. cum alis $4\frac{1}{4}$ mill. ; exp. alar. 9 mill. Ceylon. Rambodde (Nietner), in woods.

I have seen but one specimen of this extraordinary species. In all the others the superior wings are oval, the apex scarcely acute, but in *A. caudatum* they are prolonged into a sort of tail. The colours are very bright and the markings very pretty. Probably it will be advisable eventually to place *A. caudatum* in a distinct genus. I propose the name *Syllysis*."

Syllysis ritusamhara, n. sp. (Fig. 3, 39, 40, 54, 96, 111.)

Head clear brownish yellow, with extremely short, fairly dense, fine, silken, recumbent hairs. Along the front and vertex run two parallel dark brown bands which touch the somewhat concave eye-borders laterally and the hinder ocelli inwardly, leaving between them an equally broad clear longitudinal tract free. Occipital margin sharp edged, the edge rounded ; somewhat concave. Suture of the vertex very fine. Suture between front and vertex distinct. Forehead long and flat. Clypeus rather small, prominent, blackish brown. Clypeolus narrow, yellow. Upper lip blackish brown, strongly diverted towards the lower side and posteriorly. Cheeks expanded lobe-like below, with arcuate border ; separated from the front by a roundish brown spot in which, close in front of the eye-border, the insertion of the antennæ occurs. Antennæ brownish yellow, becoming blackish beyond the middle ; in the male on all sides with close and fairly erect long pubescence, in the female with sparser and more oblique pubescence which, on the hinder side, is still sparser and shorter. Ocelli small, dark reddish brown ; interval between the posterior ocelli slightly shorter than the distance between them and the eye-borders. Eyes smooth, brownish yellow to reddish brown, generally dark spotted or banded, in the male with reddish gold sheen, glabrous, as in *S. erato*, n. sp., hardly differing in male and female. Temples quite displaced by the eyes. Maxillary palp scaleless, brownish yellow, apex of the third and the fourth joint pale brown ; sense-club (fig. 96, *sk*) of the second joint relatively short and stout. Inner lobe of maxilla figured in fig. 111.

Mesothorax black above, parapsidal furrows and hind border yellow, the scaling at these places golden. Abdomen, in spirit-specimens dirty whitish, the segmental junctions brown on the under side, anterior half brown at the sides, apex brown : finely and rather closely pubescent, without scales.

Legs yellowish grayish white, tarsi brownish yellow. The blackish brown coloration is distributed as follows :—The anterior margin of the coxæ, the basal half of the femora on the under side and a spot before the apex, the latter sometimes very indistinct especially on the hind legs ; on the upper side of the extreme base and the extreme margin of the apex ; a ring before the apex of the mid tibiæ, the hind tibiæ with exception of the base, the apex and a narrow ring in the middle ; the base and the apex of the first tarsal joint and the second and third tarsal joints.

Femora flattened, especially the somewhat expanded anterior femora. Claws (fig. 54) slender, apex moderately acute, the tooth nearer to the apex much stouter than the other ; between base and first tooth in the middle a ridge-like prominence, between this and first tooth a row of bristly hairs.

Length of hind tibia 1·34 mm. ; this carries on the outside three spurs, on the inside nine very short spurs in addition to the terminal spurs (four on the inside, two on the outside) ; each spur with a ctenidiobothrium, which presents the same peculiar structure as that of the first posterior tarsal joint. The length of the first, second, and third posterior tarsal joint is 0·83 mm. : 0·07 mm. : 0·1 mm. ; their ratio is as $8\frac{1}{3}$: $\frac{7}{10}$: 1. First posterior tarsal joint with about 29 ctenidiobothria and two end spurs ; each ctenidiobothrium very broad and arcuate, overlapping its neighbour, margin densely hairy. Second posterior tarsal joint with one end spur. Femora and tibiæ in their whole length beset with narrow silvery scales (brown on the brown parts), posteriorly abruptly truncate.

Fore wing tipped with a somewhat elongated but rounded apex in the male (fig. 39), which in the female is drawn out into a long trailing tail-like acumination (fig. 40). The marking of the wing which is produced by the dense scaling is shown in fig. 3 and is essentially as follows :—The ground colour is deep brownish black ; the wing is traversed by numerous, irregular, much interrupted, wavy, thin cross bands with golden sheen, the base of the wing, a zone at the hinder border and at the outer border and a central oblique cross band interrupted in the middle remaining free. The middle of the outermost cross bands is silvery. The tail-like elongated wing apex silvery, in the middle at the anterior margin a black spot, which indistinctly radiates posteriorly ; behind and

inwards seamed with black: parallel to the inner seam a golden band which turns inwards and ends shortly before the re-entering angle ["einspringende Ecke"] of the outer margin, in which a silvery white spot bordered with golden scales occurs; the black hinder border of the wing apex with fine golden seam. Hinder border except middle and base seamed with gold; wing base golden.

Hind wing hyaline, apical quarter with very slender pale brown scales; the ends of r_{4+5}, *m*, *cu*, and *an* scaly; hinder border long and densely pubescent. Membrane of the hind wing iridescent from green to intense red. Venation and scaling are explained in the diagnosis of the genus.

Length of fore wing in male 4 mm., in female 4·2 mm.; wing expanse in male 9 mm., in female 10 mm.

Ceylon. Peradeniya; on tree trunks; February, 1905. Seven males (6 in alcohol) and eight females (1 in alcohol). Again in March, 1905, seven males and one female; collected by Mr. E. E. Green.

Amphientomum, Hagen. 1856.

Hagen. in Berendt. Benst. Org. 1856., Taf. II., p. 61. Taf. VII., fig. 21. Taf. VIII., fig. 10.

Hagen. Ent. Mo. Mag., vol. II., 1865., p. 148. *Id.* Verh. Zool. Bot. Ges. Wien., 1866, p. 203. *Id.* Ent. Zeit. Stettin., 1882, pp. 268–276. Taf. I., fig. VI., 1–8.

Enderein, Ann. Mus. Nat. Hung. Bd. I., 1905, p. 310. *Id.* Zoolog. Anz. Bd. 29, 1905, pp. 576–580, fig. 1–5.

Large forms, only known fossil in amber. Differs from the nearly related recent genera *Paramphientomum*, n. g., *Stimulopsis*, n. g., and *Seopsis*, n. g., by the absence of the radial branch r_1 from the hind wing; from the two last-named genera it also differs in the fact that the claws carry two teeth before the apex. Maxillary palp without spurs.

Table of the Species.

1. Scales of fore wing abruptly truncate at the end 2.
   Scales of fore wing emarginate at the end .. *colpolepis*, Enderl. 1905.

2. These scales shorter and broader, lateral borders converge towards the base .. *paradoxum*, Hag. 1856.

   These scales longer and narrower, lateral borders parallel .. .. .. *leptolepis*, Enderl. 1905.

Amphientomum colpolepis, Enderl. 1905.

A. paradoxum. Hag. 1856. Hagen. Ent. Zeit. Stettin, 1882, p. 268 partim.

A. colpolepis, Enderlein, Zool. Anz. Bd. 29, 1905, p. 577, figs. 2 and 3.

In the fore wing the cross vein between radial ramus and media is longer and more oblique than in *A. paradoxum*, Pick. Hag. The pterostigma appears to be shorter and narrower. In the hind wing the base of the radial ramus is absent so that the latter appears to arise from the media; r_1 reaches the anterior margin near the end of r_{2-3}.

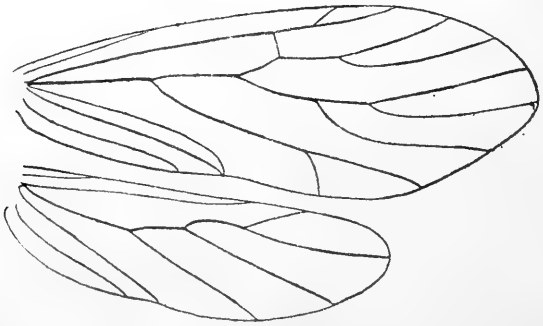

Fig. 1. *Amphientomum colpolepis*, Enderl.
Venation of fore wing and hind wing, × 27.

The distal portion of the subcosta, which forms the basal boundary of the pterostigma, is clearly recognisable and fairly distant from the point of origin of the radial ramus.

Terminal joint of maxillary palp relatively slender. First joint of posterior tarsus with about 27 ctenidia; the same joint 0·7 mm. long, second joint 0·06 mm., third joint 0·11 mm.

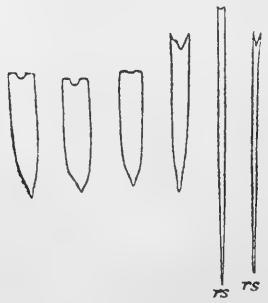

Fig. 2. *Amphientomum colpolepis*, Enderl.
Scales of fore wing; *rs* marginal scales × 280.

Scales of fore wing slender, at the end smoothly truncate, and in the middle more or less deeply emarginate ; the marginal scales (*rs*) have two more or less long apices. Some scales near the margin, which are somewhat elongated, sometimes show an indication of a third denticulation. The scaling of the fore wing appears blackish with only a few small marginal spots between the ends of the veins.

Length of fore wing about 3·15 mm.

Found in amber of East Prussia. One specimen, No. 91 of the Künow Collection in the possession of the Paleontological Institute of the Royal Museum of the Natural History ; also one of the specimens which Hagen assigned to *Amph. paradoxum*, Hag., in his new monograph on the Psocidæ in amber (Stett. Ent. Z., 1882, pp. 217–237 and 265–300).

Amphientomum paradoxum, Pict. Hag. 1856. *A. paradoxum.* Hagen im Berendt. im Bernst. bef. Organismen II., 1856, p. 61, Taf. VII., f. 21. Taf. VIII. f. 10 ; Hagen. Ent. Z. Stettin., 1882, pp. 268–276. Taf. I., fig. VI., 1–8 ; Enderlein, Zoolog. Anz. Bd. 29, 1905, p. 579, figs. 1, 4, and 5.

In all the available material examined by Hagen in 1882, the base to the radial ramus of the hind wing is constantly present. Hagen omits this stretch of vein from his figure and has presumably selected the hind wing of object No. 91 (*A. colpolepis*, Enderl.), which is preserved rather favourably, and has correlated it with

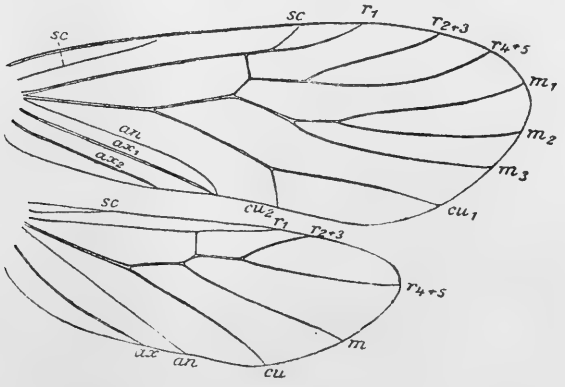

Fig. 3.—*A. paradoxum*, Hag. × 27.

Venation of fore wing and hind wing.

the fore wing of the typical *A. paradoxum*, Hag. It is clear with what caution the combination of several fragments should be undertaken.

r_1 always reaches the margin of the hind wing near the end of r_{2+3}.

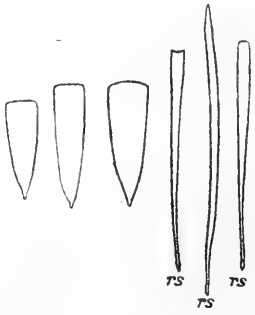

Fig. 4.—*A. paradoxum*, Hag.

Scales of fore wing × 280; *rs* = Marginal scales.

The scales are moderately slender, and usually expand feeble towards the end, where they are directly or somewhat roundly truncated. The slender marginal scales (*rs*) rarely show an extremely shallow emargination at the end (*cf.* fig. 4). The distal part of the subcosta, which closes the pterostigma in the fore wing, appears to be partly present in this species, and partly absent. It is certainly present in Nos. 81, 84, 85, and 95, whereas otherwise it is apparently lacking (Nos. 87, 89, 92).

Fig. 5.—*A. paradoxum*, Hag. Claw × 280.

Claw with two teeth before the curved apex; before the teeth three or more bristle-like hairs (fig. 5 from No. 89). The length of the first joint of the posterior tarsus varies from 0·85–0·88 mm.; that of the second joint from 0·08–0·09 mm.; that of the third from 0·1–0·12 mm.; the number of ctenidia on the first hind tarsal joint varies between 29 and 32; one specimen has 34 (No. 95).

The above statements supplement Hagen's detailed description (*l.c.* 1882). *Locality*: In East Prussian amber.

I had at my disposal Nos. 81, 82, 84–87, 89, 92, 93, 95, and 162 (nymph) from the Künow Collection. Nos. 81 and 85 present a quite colourless gold gleaming scaling; these animals had probably been sun-dried and bleached before they were completely saturated with the resin.

Amphientomum leptolepis, Enderl. 1905. A. paradoxum, Hagen. Ent. Z. Stettin, 1882, p. 268, partim. A. leptolepis, Enderlein Zool. Anz. Bd. 29, 1905, p. 580, fig. 6.

One specimen, closely resembling *A. paradoxum* in size and wing marking, differs in the very long, slender, and narrow form of the scales of its fore wing (fig. 6); the sides appear to be quite parallel.

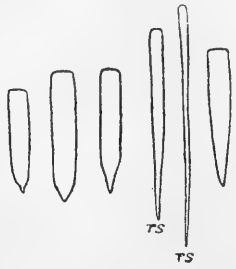

Fig. 6.—*A. leptolepis*, Enderl. Scales of fore wing × 280 *rs*= Marginal scales.

In addition, the number of the ctenidiobothria of the first hind tarsal joint reaches the number of about 36, which I have not observed in *A. paradoxum*. The length of the first hind tarsal joint is about 0·8 mm.; of the second 0·1 mm.; of the third 0·11 mm.

I leave it doubtful whether the specimen under reference represents a separate species or whether it is to be regarded as a variety of *A. paradoxum*, Hag.

In East Prussian amber. No. 94 of the Künow Collection.

Paramphientomum, n. g.

Type: *P. Nietneri*, n. sp.

Closely related to the fossil genus *Amphientomum*, Hag., from which it differs by the absence of the first radial branch (r_1) in the hind wing. Claws with two teeth before the apex. Maxillary palp (2nd–4th joints) with spurs.

A large form which is extraordinarily similar in marking to *A. paradoxum*.

One species from Ceylon.

Paramphientomum Nietneri, n. sp. (figs. 7, 27–29, 34, 56, 112.)

Head clear brownish yellow, dull, and glabrous, almost hemispherical since all parts (eyes, clypeus, &c.) are developed without convex projections and without projecting edges; the occipital margin is very sharp, steeply descending; the sharp edge slightly rounded and straight. Suture of vertex very fine; middle of the

vertex with two broad brownish longitudinal streaks, leaving free only a very fine yellowish line along the suture. Temples absent. Eyes relatively small, not prominent, hairless, brownish, with red-golden sheen. Cheeks strongly arched, expanding below, whitish yellow. Clypeus relatively small, set off by a fine groove, slightly convex. Clypeolus narrow, pale. Upper lip smooth, black. Maxillary palp pale yellowish, end joint slender and brown; second joint with two spurs, third with three, fourth with two strong and relatively long spurs.

Ocelli (fig. 34) very small, the anterior ocellus half the diameter of the posterior ocelli; the interval between the latter about half as great as the interval between them and the eye-borders. Suture between forehead and vertex absent.

Antennæ thin, about three-fourths the length of the fore wing, brown, the three first joints clear brownish yellow, fairly closely and fairly long pubescent, at the base chiefly pubescent in front only (probably all specimens female). Inner lobe of maxilla represented in fig. 112.

Mesothorax brown above, beset with gray scales which have mostly dropped off. Abdomen of dried specimens brown. Legs clear brownish yellow to whitish yellow. The following parts are dark brown :—The extreme upper apex of the femora; the tibiæ with exception of the apex and of a ring in the middle, in the hind tibiæ with exception of the base also; the first tarsal joints except the apical third in the fore leg, and the apical half and more in the middle and hind legs. Femora little expanded, the hind femora not expanded. Hind tibiæ with a great number of almost upright, short (long in comparison with *syllysis*, &c.) spurs which are distributed on all sides of the tibia. The length of the anterior tibia is 0·57 mm., of the middle 0·63 mm., and of the posterior tibia 1·23 mm. Claws (fig. 56) slender with two teeth before the apex and inwardly outside the edge with fine hairs. The length of the first, second, and third fore tarsal joints respectively is 0·42 mm., 0·08 mm., 0·01 mm.; of the mid tarsal joints 0·45 mm. 0·07 mm., 0·09 mm.; of the hind tarsal joints 0·85 mm.; 0·1 mm. 0·14 m.m. The ratio of the hind tarsal joints is therefore as $8\frac{1}{2} : 1 : 1\frac{2}{5}$. First hind tarsal joint with about 27 ctenidiobothria. Femora, tibiæ, and first tarsal joints scaly.

The closure of the pterostigma fails through the absence of the distal piece of the subcosta (fig. 27). Stigma sac well developed, short and thick. Membrane of fore wing brown, apical angle almost hyaline. Veins brown, those of the apical third dark brown. In consequence of the scaling, a gray silver ground colour is present,

which is interrupted by black brown marking (fig. 7), rather variable; the veins are generally seamed with yellow, feebly golden scales, which more or less disappear in dark specimens, but numerous yellow scales are always found. The brown marking is illustrated in fig. 7, and is very similar to that of *Amphientomum paradoxum*, Hag., from the amber; frequently it spreads still more over the wing, sometimes it becomes somewhat reduced especially in the apex. In the hind wing the scaling of the outer margin is only slightly continued in the apex into the membrane, the latter iridescent intense violet, red to golden.

The scales of the fore wing are long, slender, with parallel sides and moderately emarginate ends (fig. 28); marginal scales slender, rather narrow, with two generally very long apices. Scales of the outer margin of the hind wing similarly deeply bifid at the end.

Length of fore wing 2·6–3·4 mm.; expanse of wings 6–8 mm.

Ceylon, Peradeniya, on moist walls. January, 1905, sixteen specimens, probably all female. June, 1905, one specimen. Collected by Mr. E. E. Green.

I have dedicated this species to Mr. Nietner, who collected, with so much interesting material of other orders in Ceylon, the examples of the Amphientomides and Lepidopsocids diagnosed by *Hagen*.

Stimulopalpus, n. g.

The first radial branch is lacking in the hind wing. Maxillary palp (fig. 130) with spurs at the second, third, and fourth joints. Claws (fig. 128) with one tooth before the apex. Hind tibia with numerous spurs.

One large species from Japan.

Scales of the fore wing (fig. 129) deeply emarginate, especially the marginal scales (*rs*), which have two long to very long apices; scales of hind wing resembling the latter.

Stimulopalpus japonicus, n. sp.

Plate C., Figs. 127–130.

Head pale grayish white; upper lip and clypeus dark brown, as are also the sides of the forehead and a narrow median cross bar before the anterior ocellus upon the forehead.

The vertex is brown except for a large round spot in the middle of each half, and the distinct suture of the vertex. The neighbourhood of the ocelli is grayish white.

Antennæ very thin, about three-fourths the length of the fore wing; dark brown with exception of the first three joints; sparsely

pubescent. Terminal joint of the maxillary palp brown; sense clubs (fig. 130 *sk*) short but stout; second and fourth joints with three spurs, third joint with four (fig. 130, sp_1 to sp_{10}). Anterior ocellus much smaller than the two posterior; the interval between the eyes and the posterior ocelli is about twice as great as that between the latter. Eyes dark brown, hairless. Clypeolus very narrow and indistinct.

Thorax pale, mesothorax brown above. Scales are lacking on the thorax, but they have probably dropped off from the specimens, all of which are preserved in spirit. Abdomen very pale, apex dark brown.

Legs pale gray white; the following parts are brown: the coxæ, the extreme base of the hind femora, a ring through the middle of the basal half of the tibiæ occupying about one-third of their length, the distal half of the tibiæ except their apical third, the basal half of the first tarsal joint (in the posterior foot rather less) and the second and third tarsal joints. Claws (fig. 128) pale yellowish, the tooth before the apex stout; before the tooth five setæ, the last of which is very long. Tibiæ and first tarsal joints beset with relatively short and moderately emarginate scales on the posterior and outer sides of the brown places, as shown in fig. 129 *b*. Hind tibia with about 18 spurs in addition to the 6 terminal spurs (fig. 127). On the front of the first hind tarsal joint, a row of eight small spurs (fig. 127 *a–h*.), and two terminal spurs besides; first hind tarsal joint with about 26 ctenidiobothria. Second hind tarsal joint with one terminal seta. Ratio of the hind tarsal joints as $9 : 1 : 1\frac{1}{2}$.

The closure of the pterostigma fails through the absence of the distal piece of the subcosta. Stigma sac short and thick, nearly globular. Membrane of fore wing brown, apical fourth hyaline, colourless. Veins brown, those of the apical third dark brown, $r–r_1$ dark brown in the entire length, only the base pale brown. On each side of the cross vein between radial ramus and media a large roundish, hyaline, nearly colourless spot (which is not present in *Paramphientomum Nietneri*, Enderl.). The scales of the wings have to a large extent fallen off, as the material is preserved in alcohol; the wing-marking cannot therefore be recognized; but they have still so far remained that their distribution in respect of scale form can be ascertained.

The scales of the fore wing (fig. 129 *a*) are extraordinarily slender and long, at the end sharply and deeply bifid; near the outer margin (fig. 129 *b*) on the contrary they are shorter and broader and less deeply incised. The marginal scales (fig. 129 *rs*) are very long, strongly expanding towards the end and deeply to very deeply befid. Those of the hind wing resemble the latter.

Length of fore wing about 3·6 mm.

Japan, Okayama, Herbst, 1904 ; twelve nymphs and five females, Collected by Hans Sauter.

The nymphs have 2-jointed tarsi. They are pale gray white, sprinkled above with gray brown. Antennæ brown, eyes gray black. Colour of the legs as in the imago. Wing sheaths long and narrow, almost equal in length to the abdomen, the hind wings rather shorter. The colour of the latter is pale yellowish gray white, that of the fore wing with a brown cross band respectively at the end of the first and second third.

Seopsis, n.g.

Type :—*S. vasantasena*, n. sp.

First radial branch in hind wing absent. Maxillary palp without spurs. Claws with one tooth before the apex.

Three small species in Ceylon.

Scales of fore wing mostly abruptly truncate at the end, only feebly emarginate in S. *vasantasena* (fig. 31) ; marginal scales and scales of hind wing more or less deeply or flatly incised.

TABLE OF SPECIES OF THE GENUS SEOPSIS.

1. Head in front with metallic green glitter. Fore wing with silvery scaling and black-brown marking .. .. .. *metallops*, n. sp.

   Head without metallic lustre .. 2.

2. Fore wing dark brown with golden marking *superba* (Hag 1865).

   Fore wing silvery with irregular golden longitudinal band in the middle ; hinder border with irregular dark brown marking ; anterior border with three brown cross bands (of which the middle one is clear gray brown) which scarcely reach the middle of the wing ; before and behind these a dark brown marginal spot .. *vasantasena*, n. sp.

Seopsis vasantasena, n. sp. (Figs. 5, 30, 31, 35, 58, 103).

Head clear brownish yellow, over the vertex four rather narrow reddish brown longitudinal streaks, the two submedian streaks very close to the distinct suture of the vertex ; they often coalesce especially in the central portion ; the two lateral streaks are near to the eye-borders, often touching them. These four brown

longitudinal bands are continued upon the relatively narrow forehead, but never coalesce there. Over the middle of the convex clypeus passes a broad brown band divided into two parts in the middle line by a fine yellow line. Clypeolus yellowish. Upper lip black-brown, at the sides brown. Cheeks whitish. Inner lobe of maxilla shown in fig. 103. Maxillary palp without spurs, whitish, the first joint and basal half of second joint brown. Eyes relatively small, black, frequently pale speckled or banded, hairless. Ocelli (fig. 35) very small, very near together. Occiput steeply descending, occipital margin rounded and emarginate in the middle. Antennæ thin, about two-thirds the length of the wing, black-brown, the three first joints reddish brown; rather sparsely pubescent, somewhat more densely towards the apex; the lengths of the eleven (antennary) joints of the flagellum in millims. are: 0·09, 0·12, 0·14, 0·12, 0·11, 0·09, 0·08, 0·08, 0·05, 0·05, 0·06.

Thorax brown, with golden scales in the middle, some silver scales at the side, most of the scales lost. Abdomen of dried specimens brownish. Legs brown, the following parts clear brownish yellow: the apices of the coxæ, the trochanters, the extreme apex of the femora below, the extreme base of the tibiæ, the apices of the tibiæ and first tarsal joints, and the very short spurs standing out on all sides of the posterior tibiæ. The length of the anterior tibia is 0·47 mm., that of the middle tibia 0·47 mm., of the hinder tibia 1 mm.

The lengths of the tarsal joints of the fore foot in millims. are 0·3, 0·05, 0·08; of the mid foot 0·33, 0·05, 0·07; of the hind foot 0·52, 0·06, 0·08. The ratio of the hind tarsal joints is therefore as $6\frac{1}{2} : \frac{3}{4} : 1$. First hind tarsal joint with about 18 ctenidiobothria. Claws (fig. 58) relatively small, one tooth before the apex, which is very long and acute, before the tooth about 7 setiform hairs. Femora, tibiæ, and first tarsal joints squamous.

The venation is illustrated in fig. 30. Pterostigma very short and small, far removed from the ramification of the radial ramus, the distal portion of the subcosta remote. Peduncle of the radial fork nearly equal to the length of r_{4+5}. The basal portion of the radial ramus is lacking in the hind wing, and the radial ramus apparently arises from the media; r_1 is absent (r ends at the place where the radial ramus should have been given off). The marking of the fore wings produced by the scaling is as follows:—Ground colour silvery, a golden longitudinal band through the centre of the wing which spreads out in the apical half as far as the hinder margin and is interrupted by two or three silver spots; in the anterior half of the wing, in front of the line joining the most anterior portion of

the root of the wing to the wing apex, occurs near the middle a clear, gray brown, rather broad cross band which runs from the anterior margin obliquely backwards and ends directly truncate. In the anterior half of the wing the following places are dark brown :—A narrow brown longitudinal band from the anterior margin of the wing base, in the first half lying against the anterior border, in the second half directed obliquely backwards and towards the wing apex ; close beside the gray brown cross band on the inner side of it a nearly equally broad parallel cross band, outside the gray brown band and also close beside it another very narrow parallel cross band. Outside the latter a dark brown marginal spot produced acutely backwards, outside this again a minute marginal spot over the apex. Hinder border with a dark brown zigzag seam, broad at the base, expanding at the end of the first third to an acute triangle, the apex of which reaches to about the middle joint between posterior and anterior margin, then becomes strongly attenuated ; it is interrupted in the middle and, before ending before the apex, encloses one or two golden spots. Hind wings hyaline, veins pale brown, apical border with long scales, hinder border with very long hairs ; in the membrane scales only occur at the anterior margin of the apex upon a very narrow zone (fig. 5) ; membrane blue to intense red violet iridescent to golden yellow.

The scales of the fore wing (fig. 31 *α*) are relatively slender, the sides parallel, feebly emarginate at the end ; the marginal scales are very narrow and long, strongly bifid at the end (fig. 31 *β*); the scales of the hind wing are slenderer and attenuate gradually toward the base and are at the end usually more or less emarginate or smoothly truncate (fig. 31. *γ. δ. ε.*), the marginal scales (fig. 31. *ξ.*) like those of the fore wing, though usually less strongly bifid at the end.

Length of fore wing 2 mm., wing expanse $4\frac{1}{3}$ mm.

Ceylon. Peradeniya. January, 1905 ; on the outer surface of walls and verandahs ; 13 specimens ; collected by Mr. E. E. Green.

Seopsis superba (Hag., 1865).

(Figs. 6, 32, 36, 123.)

Amphientomum superbum, Hagen, Ent. Mo. Mag., vol. II., 1865, p. 150.

Perientomum superbum, Hagen, Verh. d. Zool. Bot. Ges. Wien., 1866, p. 210.

Perientomum superbum, Hag., Enderlein, Ann. Mus. Nat. Hungar., Bd. I., 1903, p. 322.

Seopsis superba (Hag.) *m.*

Vertex yellowish brown to reddish brown, in the middle a dark brown longitudinal band which is sometimes crossed in the centre by a more indistinct transverse band; a narrow seam at the inner borders of the eyes. Suture of the vertex fine. Ocelli relatively close together, the interval between the two posterior ocelli one-third to one-fourth of the interval between them and the eye-borders. Forehead dark red-brown, with delicate gray pubescence. Clypeus black-brown with very fine gray pubescence, moderately convex. Clypeolus usually clear yellowish, short. Labrum black. Maxillary palp without spurs, black; end-joint, except its extreme base, whitish yellow. Antennæ about two-thirds the length of the fore wing, black-brown, the four first joints dark red-brown, the apex of the third and fourth joint, sometimes also the apex of the second joint (second basal joint), very pale brownish yellow. The length of the eleven (antennary) joints of the flagellum are in millims.: 0·15, 0·17, 0·2, 0·2, 0·16, 0·13, 0·1, 0·1, 0·07, 0·06, 0·07. Eyes fairly large, black, sometimes with golden lustre, glabrous. Temples displaced.

Thorax black above, covered with golden scales, especially behind. Abdomen in the dried animal blackish, Legs black, ends of the coxæ, the trochanters, the apices of the femora, tibiæ, and first tarsal joints clear brownish yellow to whitish yellow with golden lustre; the apices of the first tarsal joints are often only at the extreme tip pale coloured; in the hind legs this clear colour becomes sometimes almost entirely obliterated. In clearer specimens the three tarsal joints incline to a pale colouration. The length of the anterior tibiæ is 0·5 mm., of the middle tibiæ 0·48 mm.; and of the hind tibiæ 0·95 mm. The lengths of the tarsal joints of the fore foot in millims. amount to: 0·28, 0·05, 0·08; of the middle foot, 0·32, 0·07, 0·08; of the hind foot 0·6, 0·08, 0·1. Ratio of the posterior tarsal joints as 6 : $\frac{4}{5}$: 1. Claws slender, with one rather stout tooth before the apex. First hind tarsal joint with 23 ctenidiobothria. Femora, tibiæ, and first tarsal joints squamous. The posterior femur is shown in fig. 123.

Venation illustrated in fig. 32. Pterostigma very short and small, distal portion of the subcosta distinct. The basal part of the radial ramus in the hind wing is lacking (the ramus apparently arising from the media); r_1 is absent and r ends at the place where the radial ramus should begin. The pattern produced by the scaling of the fore wing (fig. 6) is the following:—Black brown to brown with golden marginal spots between the ends of the veins, a narrow golden band (which is often broken up into points) near the outer margin, and parallel to the latter; in the middle of the anterior

margin a large golden spot which radiates diffusely through the wing to the hinder margin ; at the nodulus a large golden spot which usually radiates indistinctly and diffusely towards the middle of the anterior margin ; wing base golden ; at various places isolated golden scales ; the marginal spot of the middle of the anterior margin and that between the ends of r_1 and r_{2+3} are generally the largest of the wing, sometimes the remaining golden marking decreases in proportion to these, with the exception of the outer marginal spots. In the hind wing the membrane of the apical zone with clear brownish scales ; membrane red to intense golden yellow, with greenish golden yellow iridescence.

Scales of the fore wing (fig. 36 *a*) relatively broad and short, at the end smoothly truncate, the marginal scales (fig. 36 *β*) slender, relatively broad and emarginate at the end ; scales of the hind wing (fig. 36. *γ*. *δ*. *ε*.) similarly emarginate.

Length of fore wing 2·2 mm., wing expanse $4\frac{1}{2}$ mm.

Ceylon, Peradeniya, January, 1905, one specimen on a tree trunk ; February, 1905, two specimens on tree trunks ; March, 1905, one specimen on a tree trunk ; collected by Mr. E. E. Green.

Seopsis metallops, n. sp.

(Figs. 4, 33, 57, 92, 93, 121.)

Head deep dull sammet black, rarely brownish black ; clypeus, forehead, and frontal margin of the vertex rather thickly covered with a microscopic pubescence having a strong metallic green lustre ; on the clypeus this pubescence forms very fine closely packed parallel longitudinal streaks. Over the middle of each half of the vertex passes a flat but very distinct longitudinal impression, which is continued upon the not very long forehead, where it marks off a roundish median prominence which carries in the middle a small roundish clear yellowish brown spot ; in the middle of each of the impressions of the vertex occurs an equally large and similarly coloured spot. These three clear round spots lie in the angles of an imaginary isosceles triangle, whose apical angle is little short of 60°, and they are extraordinarily deceptive, resembling the ocelli when examined with a low power lens. The actual ocelli are very small and shine like orange yellow glass beads ; the anterior is a little larger ; the distance between the two posterior ocelli is about half as great as their distance from the eyes. Clypeolus clear yellowish brown. Upper lips glossy brown black, rarely brown. Occiput steeply descending, but at the same time strongly rounded. Suture of the vertex very fine, sometimes pale brown behind. Eyes fairly large, hardly prominent. Antennæ moderately thin,

black, about three-fourths length of fore wing, very sparsely beset with scattered hairs; the lengths of the eleven (antennary) joints of the flagellum in millims. are: 0·22, 0·24, 0·28, 0·23, 0·16, 0·1, 0·08, 0·09, 0·1, 0·11. Inner lobe of maxilla shown in fig. 92; maxillary palp without spurs (fig. 93); organ of maxillary palp (sense-club, fig. 93 *sk*) slender.

Thorax dull brownish black; whether it has had scales above cannot be asserted since all examples are badly rubbed, still here and there a single silver scale appears to be present. Legs brownish black; the following parts are clear brownish yellow:—Apices of the coxæ, the trochanters, the apex of the hind femur, the base of the hind tibia; a narrow ring on the tibiæ near the end of the first third, in the hind tibia at the end of the first fourth, and the apices of the tibiæ. The short spurs which stand on all sides of the hind tibia (fig. 121) are yellowish.

The length of the anterior tibia is 0·67 mm., of the middle tibia 0·72 mm., of the hind tibia 1·33 mm.

The lengths in millims. of the tarsal joints are: in the forefoot 0·5, 0·08, 0·1; in the middle foot, 0·55, 0·08, 0·1; in the posterior foot, 0·77, 0·08, 0·1. The ratio of the hind tarsal joints is therefore as $7\frac{3}{4} : \frac{4}{5} : 1$. First hind tarsal joint with about 23 ctenidiobothria. Claws (fig. 57) very large, tooth before the apex broad and stout, the five or six hair-like setæ between the basal angle and the tooth, very stout. Femora, tibiæ, and first tarsal joints beset with slender scales.

Membrane of the fore wing dark blackish brown. Pterostigma very slender and narrow; the distal portion of the subcosta which limits the pterostigma distinct but very short, arising approximately in the middle of the length of r_1, which here forms a feeble angle. Peduncle of the radial fork as long as r_{4+5} and about twice as long as the media between cross vein and first bifurcation. Areola postica rather high and relatively short, cu_2 long, about twice as long as cu_1. The pattern produced by the scaling of the fore wing, which is almost entirely rubbed away in most of the specimens and is to some extent well preserved in one example only, is as follows:—Ground-colour whitish gray with silvery lustre. The following parts are black:—The base (more extended behind), a cross band through the middle and another through the end of the third quarter, as well as the apex; all the dark markings are much interrupted by roundish silver spots; the markings of the apical half are united by irregular black anastomoses.

Scales of fore wing (fig. 33) very broad, the sides attenuating towards the base, with feebly arcuate almost directly truncate

ends (fig. 33. β.), rarely, towards the outer wing margin, very shallowly emarginate at the end (fig. 33. γ.). Marginal scales (fig. 33 δ) hair like. In the hind wing the hyaline membrane and the pale grayish brown veins are completely scaleless and hairless; outer and hinder margin long haired, only at the outer margin between the hairs occur single slender scales (fig. 33, $\varepsilon.\zeta$), which are incised at the end. Membrane of hind wing with dull gray lustre.

Length of fore wing 2·4 mm., wing expanse 5½ mm.

Ceylon, Diyatalawa. April, 1905; on rocks; ten specimens probably female; collected by Mr. E. E. Green.

Hemiseopsis, n. g.

Type:—H. Fülleborni, Enderl. 1902.

First radial branch (r_1) present in hind wing. Claws with one tooth before the apex.

One large species from Africa.

Hemiseopsis Fülleborni, Enderl. 1902.

Amphientomum Füllebornii, Enderlein. Mitt. Zool. Museum, Berlin. Bd. II., 2 H., 1902, pp. 14-15. Taf. 5, figs. 1, 4, 6, 8, 10, and 11.

Head reddish brown. Eyes large, somewhat prominent. Antennæ with nearly hairless joints of usual size; perhaps 13-jointed; the ends are broken off, but they appear to be shorter than the fore wing. Upper lip fairly large. Clypeus convex, feebly emarginate in front; with the microscope a meshwork can be seen whose more compact places are beset with very small round clear spots. Clypeolus not marked out. The two mandibles highly asymmetrical. Inner maxilla of a complex shovel shape. Anterior ocellus nearly at the anterior margin of the rather broad forehead, the two posterior ocelli in the extreme anterior angles of the vertex, close beside the eyes. Vertex quite hairless, suture rather fine. Occipital margin rather steeply descending. Maxillary palp brown, first joint very short, second longest, third very short, fourth nearly as long as second; second and third joints with narrow hair-like scales.

Prothorax rather broad and clearly visible from above, very pale brown. The remaining thorax clear brown with pale sutures. Abdomen pale brownish white, the two last segments clear brown. Legs clear brown, apices of the femora, tibiæ, and of the first tarsal joints pale, likewise the middle of the tibiæ. Fore legs beset with

scales. Claws with a large acute tooth before the apex, the rest of the anterior margin of the claws beset with long delicate hairs. First hind tarsal joint with a row of 22 setæ with slightly developed ctenidiobothria. Ratio of the hind tarsal joints as 6 : 1 : $1\frac{1}{4}$.

Wings hyaline, feebly brown ; fore wing with brown tinted basal half, only at the anterior margin of the base and along the analis clearer ; the brown colour becomes gradually fainter towards the outer margin. Veins brown, analis and veins of the apical half dark brown. The second axillaris long and distinct. In the hind wing the media, ramus radialis, and cubitus are brown, the remaining veins pale ; the axillaris is very long. The base of the fore wing is sparsely beset with scales, which are arranged fairly symmetrically on both wings. Head, body, and legs (apart from the fore legs) without scales. The distal end of the scales is only slightly convexly truncate.

Length of fore wing $3\frac{1}{4}$ mm., wing expanse $7\frac{1}{2}$ mm.

German East Africa. Lagenburg on Lake Nyassa. Captured at lantern, November 24, 1899. One female ; collected by Dr. Fülleborn.

A nymph which doubtless belongs to *Hemiospis Fülleborni* is yellowish with faint brownish wing sheaths in which the definitive venation shows through and is particularly distinct in the distal half. The antennæ are distinctly 13-jointed ; the last joint presents at the end an extremely short and faint constriction, which however does not represent an articulation. The hairs of the antennæ are moderately dense and long. The tarsi are 2-jointed, as in the larvæ and nymphs of all species with 3-jointed tarsi in the adult, nevertheless one sees through the nymphal skin two distinct joints lying within the second joint, the first of which is beset with setæ, the second being destitute of these structures, but having ctenidibothria. The inner lobes of the maxillæ are primitively bifid.

Length of fore wing $1\frac{1}{4}$ mm., of hind wing 1 mm. Body length $2\frac{1}{2}$ mm.

German East Africa. Mararupia, Ukinga. In a forest ravine, on leaves, September 22, 1899, collected by Dr. Fülleborn.

Stigmatopathus; Enderl. 1903.

Enderlein, Ann. Mus. Nat. Hung., Bd. I., 1903, p. 312.

Ocelli absent. Only one axillary vein in the fore wing. R_1 and *sc* of the pterostigma lie close beside one another. In the hind wing r_1 is absent. Claws with one tooth before the apex.

Stigmatopathus Horváthi, Enderl. 1903.

Enderlein, Ann. Mus. Nat. Hung., Bd. I., 1903, p. 313.

Taf. 57 *a–e*.

In the marking of the fore wing this species reminds somewhat of *Seopsis vasantasena*, Enderl.

Further India, Malacca.

Fam. LEPIDOPSOCIDÆ.

Enderlein, Ann. Mus. Nat. Hung., Bd. I., 1903, pp. 206 and 319

Head large but very short ; forehead and vertex very densely and shaggily hairy, rarely thin-haired but always long and shaggy. Eyes and clypeus very little convex. Occiput very steeply descending and sharp-edged, the edge usually little rounded. Eyes moderately large with very dense and short sammet-like pubescence. The three ocelli far asunder, the anterior ocellus sometimes smaller ; they are only absent in *Echinopsocus*, Enderl., 1903. Maxillary palp 4-jointed, first joint very short, the last strongly expanded and cut off at the end like an axe. Inner lobe of maxilla narrow at the end, with three long apices. Organ of the maxillary palp in the form of a short sense club on the inner side of the second joint of the palp. Labial palp 2-jointed, both joints distinctly separated. Antennæ usually thin, with sparse and rather long pubescence, which towards the base becomes long and shaggy ; the number of antennary joints amounts in the Perientominæ to about 20–25, in the Lepidopsocinæ and Echinopsocinæ about 30–47. The (antennary) joints of the flagellum are relatively long in the Perientominæ, in the Lepidopsocinæ and Echinopsocinæ very short (moniliform) or at most about twice as long as thick.

Prothorax large, very short but lying in front of the mesothorax (not concealed under the latter), distinctly visible from above and free ; mesonotum densely scaly. Femora and tibiæ beset with slender scales. Hind tibia (fig. 117) with a great number of very long stout setæ on the outer side distributed along the whole length. Tarsi 3-jointed. First hind tarsal joint with a row of ctenidiobothria (ctenidia). Claws with one tooth before the apex, rarely traces of two others ; without hair-like denticles. Empodial appendix setiform.

Fore wing more or less broad to narrow ; on the outer side usually more or less strongly acuminate, sometimes drawn out into a long thin apex. The subcosta bounds a much thickened, strongly chitinised, narrow area, which extends along the anterior margin from the base approximately up to the middle of the wing and is densely beset with very long and thick upright setæ (macrochætæ). The distal piece of the subcosta which bounds the pterostigma is very long and never wanting ; in the Echinopsocinæ it is unusually

long. The pterostigma is large, cell-like, not strongly chitinised (as it is in most Copeognatha), but thin-walled; in the Echinopsocina it is a very long triangular cell projecting deep into the wing. Stigma sac at the basal part of the distal stretch of *sc*. In the genus *Soa*, Enderl. 1903, the subcosta (*sc*) is not divided into two parts, as in all the other Copeognatha; a cross vein between the end of the proximal part of the subcosta and the stem of the radius effects the union (fig. 41). The pterostigma (branch r_1) is united with the peduncle of the radial fork by a cross vein, or fused with it over a certain extent; by this means a small 5–6 angled cell is enclosed which is absent in *Lepidopsocus* and the Echinopsocinæ. In the Echinopsocina the radial ramus is not bifurcated but simple. Media triramous or biramous (*Echinopsocus*, Enderl., 1903). Radial stem in *Lepidopsocus*, Enderl., 1903, and the Echinopsocina strongly reduced in the basal portion, so that only one row of setæ or insertion-cupules indicate its course. Radial ramus constantly fused with the media over a greater or lesser extent. Areola postica long, peduncle usually short; cu_1 and cu_2 very long. Analis and axillaris never end at one point, but always separated from one another by an interval.

In the hind wing the radial stem and the median stem coalesce (Lepidopsocinæ), or are only separated by a long and extremely narrow cell (Perientominæ). Radial ramus concrescent with the media in the basal part, consequently r_1 apparently arises from the media or radial ramus. Media with two quite separate branches. In the Echinopsocinæ the hind wing is absent or only developed in miniature.

Fore wing and hind wing with pronounced sharp and broad marginal vein. Membrane of fore wing densely scaled; no delicate short hairs between the scales but only scattered very long stout hair-like scales. Veins and a narrow marginal zone of the fore wing with some stout setæ (macrochætæ). The wing margin is beset with very long hairs which are inserted upon plug-shaped cupules which are closely arranged in numerous transverse series on the marginal veins. Hind wing entirely scaleless. At the border of the fore wing occur some moderately long spindle-shaped marginal scales whose edge in the apical half is finely spinose or serrate (fig. 51 *rs*).

In the Perientominæ the scales are strongly differentiated. Besides the slender fusiform sometimes more or less serrate marginal scales in the dorsal half of the fore wing there are two forms of scales on the membrane of the fore wing, the one kind is much larger and relatively longer (COVER SCALES), the other smaller and relatively shorter (GROUND SCALES). The former are present

in fewer numbers than the latter. Both are usually shorter or longer fusiform, frequently with acutely produced apex; rarely are they oval or elongate elliptical; sometimes the ground scales are more or less faintly truncate at the end with rounded angles or feebly emarginate (*Perientomum Greeni*, Enderl., fig. 53); in *Perientomum triste*, Hag. (fig. 63) the ground scales are fusiform, the cover scales spatuliform with concave end (rarely with rounded end); in *Nepticulomima chalcomelas*, Enderl., all the scales are spatuliform with straight cut or feebly concave end. In the Lepidopsocinæ the scales are uniformly asymmetrical with produced apex (fig. 107), only the marginal scales are symmetrically fusiform; in the Echinopsocinæ similar scales occur, but they are intermingled with symmetrical fusiform (*Echinopsocus*, Enderl.) or spatuliform and fusiform (*Scolopama*, Enderl., fig. 109). The margin of the fore wing is in the majority densely beset with very long hairs. There are never any scales on the hind wing.

TABLE OF THE SUB-FAMILIES OF LEPIDOPSOCIDÆ.*

1. Fore wing with stout macrochætæ only in the costal area; hind wing with distinct but very narrow closed radial cell (*R*); scales of the wings, the body, and the legs all symmetrical. Antennæ with about 20 to 25 joints, the individual joints relatively long .. .. .. PERIENTOMINÆ.

*Where the scaleless genus *Thylax*, Hag., 1865 (which is probably the representative of a special sub-family, Thylacinæ) is to be placed, cannot be established on the basis of Hagen's description. I have just received the work of Meunier, entitled "Perientomum mortum, Hag. (Meun.), archiptère Psocide du Copal fossile de Zanzibar; Le Naturaliste No. 456, 1906." A comparison with the species of the genus *Perientomum* shows that the venation of the hind wing diverges from that of all Perientomidæ in the union of the two median branches (m_1 and m_2) to a fork. Meunier says nothing about scales, and since the long hairs of the fore wing are inserted in fig. 3 the scaling would certainly have been mentioned. Now, as the Empheriidæ (*cf.* p. 18) have constantly a median fork in the hind wing, and Hagen's description (Ent. Monthly Mag., vol. II., p. 172) fully agrees with the description and illustration of Meunier, especially in comparison with *Empheria*, Hag., and finally the wings are destitute of scaling, it seems to me to be very probable that Meunier has had *Thylax* before him.

Even if it should turn out that this animal is in fact scaly, I think it highly probable that *Thylax madagascariensis* and *Perientomum mortuum* are identical and that the former has only been strongly rubbed; then *Thylax* would have to be placed near *Perientomum* among the Perientominæ. Against this, however, there is the fact that the Lepidopsocidæ never possess a median fork in the hind wing, and it seems to me therefore in the highest degree probable that my view expressed above on p. 48 is the correct one, namely, that *Thylax* Hag., represents the type of a distinct sub-family, the Thylacinæ, which is to be classified under the Empheriidæ.

Fore wing with usually very long macrochætæ on the costal area and also on the veins, sometimes also on the membrane of the marginal seam. Hind wing without radial cell (without a closed cell); sometimes greatly reduced or absent. The wing scales all asymmetrical (Lepidopsocinæ) or at least predominantly so. Antennæ moniliform, with more than 30–47 very short joints, or at most the joints are as much as twice as long as thick .. .. .. 2.

2. Radial ramus bifurcated. Hind wing without radial cell, otherwise normal .. LEPIDOPSOCINÆ.

Radial ramus not forked. Hind wing much reduced, without veins; or quite absent .. .. ECHINOPSOCINÆ.

Sub-family PERIENTOMINÆ.

Enderlein, Ann. Mus. Nat. Hung. I., 1903, p. 208.

TABLE OF THE GENERA.

1. Wing broad, strongly rounded at apex. Subcosta not broken up into two parts; the ramus communicans is a cross vein towards the stem of the radius .. .. *Soa*, Enderl. 1904.

[Type :—*S. Dahliana*, Enderl. 1904.]

Wing more or less narrow, more or less acuminate; subcosta as in all other Copeognatha broken up into two parts, the ramus communicans being absent .. .. 2.

2. In the hind wing r_1 arises between the points of origin of m_1 and m_2 .. 3.

In the hind wing r_1 arises between the origins of m_1 and r_{4+5}. (In the fore wing r_1 coalescent with the peduncle of the radial fork for a short distance or at one point) .. *Nepticulomima*, n. g.

[Type :—*N. Sakuntala*, n. sp.]

3. In the forewing r_1 (posterior border of pterostigma) coalescent with the peduncle of the radial fork for a short distance or at one point .. *Perientomum*, Hag. 1866.

[Type :—*P. trichopteryx*, Hag. 1859.

In the forewing r_1 united with the peduncle of the radial fork by a cross vein .. .. .. *Lepium*, n. g.

[Type :—*L. chrysochlorum*, n. sp.]

Soa, Enderl. 1904.

Enderlein, Zool. Jahrb. Syst., Bd. XX., 1904, pp. 109–110.

Taf. 7. f. 2–9.

Type: *Soa Dahliana*, 1904.

Wing broad, strongly rounded at apex. Subcosta not divided into two parts, as it is in all other Copeognatha ; the ramus communicans is a cross vein towards the stem of the radius. Claws with two teeth before the apex. Scales (fig. 44) oval, partially roundly truncate at the end. Marginal scales narrow, truncate at the end. End joint of maxillary palp large, more or less axe-shaped. The three ocelli fairly close together, the anterior ocellus very small. Head very sparsely hairy. Antennary joints long.

Table of the Species.

Hair of the outer margin brown. Maxillary palp brown ; end joint relatively narrow, rather rounded at the end .. *Dahliana*, Enderl. 1904.

Hair of the outer margin bright yellow. Maxillary palp brilliant black ; end joint broad, at the end obliquely truncate .. .. *flaviterminata*, n. sp.

Soa flaviterminata, n. sp. (Figs. 8, 41, 44, 59).

Head brilliant dark brown, sparsely beset with long and short black hairs ; labrum and clypeolus yellowish. Clypeus remarkably small, hemispherical. Forehead very long. Ocelli fairly close together, the anterior ocellus very small. Suture of vertex very delicate. Eyes moderately convex, large, black ; pubescence extremely short, close and fine. Occipital margin sharp like a knife edge and descending at an acute angle ; in the middle somewhat excavated. Antennæ thin, brown, about two-thirds length of fore

wing, then broken off; 18 joints present. Antennary joints of the flagellum long, as in *Perientomum*, sparsely beset with long hairs. The lengths of the existing antennary joints in millims. are: 0·06, 0·08 (basal joints), 0·19, 0·15, 0·14, 0·12, 0·09, 0·09, 0·08, 0·09, 0·08, 0·09, 0·1, 0·09, 0·1, 0·09, 0·08, 0·09. Maxillary palp brilliant black, pubescence gray; end joint thick, broad, obliquely truncate at end.

Thorax dark reddish brown; mesonotum, as it appears, has been covered with dark brown scales which, however, in the present specimens have been rubbed off. Legs brown to black-brown, ends of the tibiæ and tarsi brownish yellow. The length of the anterior tibia is 0·57 mm., of the middle tibia 0·65 mm., of the posterior tibia 1·05 mm. The lengths of the tarsal joints in the fore foot are respectively 0·24, 0·07, 0·08 millims.; in the middle foot 0·25, 0·07, 0·08; in the hind foot 0·42, 0·07, 0·08. The ratio of the hind tarsal joints is therefore as $5\frac{1}{4} : \frac{7}{8} : 1$. First hind tarsal joint with about 17 ctenidiobothria. Claws (fig. 59) large, with large stout tooth rather distant from the thin apex, long setiform semi-circular empodial appendix curved inwards and a small tooth between this and the tooth before the apex.

Wing large, very broad, and relatively short, strongly rounded at the apex. Membrane of fore wing blackish brown. Veins dark brown. Pterostigma very narrow, but deep. Peduncle of the radial cell short, m_1 ending below the apex. Scaling dark brown with intense red silken lustre (fig. 8); in a second specimen this lustre is dull dark greenish; it appears to be subject to great variation. Marginal hair rather short, that of the anterior margin up to the apex blackish, that of the outer margin up to the apex bright yellow with silken lustre (fig. 8). Hind wing hyaline, veins gray brown; marginal hair long, gray. Membrane of the apical third and a narrow zone at the anterior and posterior margin pubescent. Radial cell, R_1 fairly narrow. Membrane brightly iridescent from red to green.

Scales ovate (fig. 44), partly feebly truncate at the end, though strongly rounded. Marginal scales (*rs*) narrow and long, truncate at the end, but rounded at the angles.

Length of fore wing 2·4 mm. wing expanse $5\frac{1}{2}$ mm.

Ceylon, Peradeniya. On the wall of the bungalow verandah; April. 1905; two specimens, collected by Mr. E. E. Green.

Soa Dahliana, Enderl. 1904.

Enderlein, Zool. Jahrb. Syst., Bd. XX., 1904, pp. 110–111. Taf. 7, figs. 2–9.

Bismarck Archipelago. Ralum (New Britain).

Lepium, n. g.

Type: *L. chrysochlorum*, n. sp.

Wing more or less acuminate. The first radial branch (r_1) in the hind wing arises between the origins of m_1 and m_2. In the fore wing r_1 (the posterior border of the pterostigma) is united with the peduncle of the radial fork by a cross vein.

Claws with one tooth before the apex. Scales fusiform with more or less produced apex (figs. 61 and 65). Pterostigma relatively small and narrow.

TABLE OF THE SPECIES.

Wing broad, apex subacute. Scaling of fore wing brown-black with metallic green lustre with some golden scales intermingled ..	*chrysochlorum*, n. sp.
Wing narrow and strongly acuminate towards the apex. Scaling of fore wing blackish brown to dirty gray-brown ..	*luridum*, n. sp.

Lepium chrysochlorum, n. sp. (fig. 15).

Perientomum morosum, Hag. Enderlein, Ann. Mus. Nat. Hung. I., 1903, p. 323. Taf. XIII. figs. 64 and 64*a*; and Taf. XIV., fig. 64 *b*.

Head clear brown-yellow, closely beset with long, brownish, setiform hairs. Occiput moderately compressed lamelliform, fairly sharp. Maxillary palp with axe-shaped terminal joint, which is black-brown. Eyes rather large, somewhat prominent, brown; closely and finely pubescent. The posterior ocelli distant from one another, large, rather near the eyes; anterior ocellus small. Occipital margin fairly sharp. Upper jaws strongly asymmetrical. Inner maxilla with three long and widely separated main teeth which, in part, carry further indistinct teeth. Labial palp distinctly 2-jointed, first joint with two hairs above, second joint large, with some setæ, at the end closely beset with long taste bristles. Lobus externus of the labium rather small, lobus internus only occurring as a vestige. The two chitinous filaments of the paraglossæ of the hypopharynx join together far back. Antennæ short and thin, 16 joints are preserved, the rest broken off: pale brown, sparsely beset with long, almost setiform hairs.

Prothorax short but broad, clearly visible from above. Thorax and abdomen pale brown. Legs clear brown yellow, fore legs pale;

tibiæ strongly and thickly beset with narrow scales and with a number of very long, erect set, especially the hind tibiæ. Femora closely beset with broad scales and long, delicate hairs. Tarsi without scales. First tarsal joint closely beset with short setæ. First hind tarsal joint with about 19 ctenidiobothria, second hind tarsal joint with 3 ctenidiobothria, third hind tarsal joint almost hairless. The teeth of the ctenidiobothria are hair-like and each ctenidiobothrium consists of a large number of long and delicate hairs arranged in a row. Claws very long and narrow with a small stout, rather blunt tooth near the apex. Empodium with a seta on each side. Ratio of the hind tarsal joints as 5 : 1 : 1.

Fore wing closely beset with brown-black scales, among them evenly distributed golden and metallic green scales; the fore wing seen from a distance thus acquires an olive greenish golden hue. Between the scales occur long curved hairs which partly stand upon the veins. The hinder margin as far as cu_2 is hairless, the remaining border with very long, close set, brownish hairs. The marginal hairs are inserted upon long stalked hair cupules arranged in transverse rows on the marginal veins. The posterior area of the wing base is formed by a smooth clear brown tract, which carries about 30 large hair cupules but is without hairs. The area between costa and subcosta is strongly chitinised, without scales and beset with long erect dark setæ. The scales are symmetrical and bluntly acuminate in front. Radial ramus united with the media for a moderately long distance. Radial cell narrow somewhat shorter than the peduncle. The latter connected with the pterostigma by a short cross vein; cu_1 and cu_2 very long, cu_1 about 7 times as long as cu; cu_2 about 5 times as long as cu. The axillaris does not reach the analis at the end; the latter is accompanied by a very narrow hyaline seam. Stigma sac occurs as a strong tracheal expansion at the base of that portion of the subcosta which abuts upon the pterostigma, with few (about 7) regular, free, strongly enlarged and thickened portions of the tracheal spirals.

Hind wings hyaline; margin with very long and close set hairs with exception of the anterior margin of the costal cell. Anterior margin of the basal half of the costal cell with short hairs. Veins of the apical half biserially pilose, membrane of the apical zone with short hairs. The portion of r which shuts in the extremely narrow radial cell R in front, is feebly curved and is developed as a well marked vein. Hind wings intensely and brilliantly iridescent in all colours.

Length of fore wing $2\frac{1}{2}$ mm., wing expanse $5\frac{1}{2}$ mm.

India, Matheran near Bombay, at 800 metres elevation, July 10, 1902; one male (Biró collection).

Lepium luridum, n. sp. (Figs. 16, 64, 65, 73.)

Head, thorax, and legs dirty yellow-brown to brownish yellow. The similarly coloured hairs on forehead and vertex shaggy. Eyes rather convex, spherical, brown-black; pubescence very short, fine and compact. Antennæ thin, brownish yellow, about three-fourths the length of the fore wing; pubescence fairly compact and long; antennæ incomplete, 24 joints present; the lengths of the individual joints in millims. are the following: the two basal joints, 0·05 and 0·07; the remaining joints, 0·09, 0·09, 0·1, 0·1, 0·07, 0·08, 0·07, 0·06, 0·07, 0·08, 0·07, 0·06, 0·07, 0·05, 0·06,0·06, 0·06, 0·07, 0·08, 0·06. 0·06, 0·06. Maxillary palp clear brownish yellow.

Mesonotum with gray brown scales. The length of the anterior tibia is 0·48 mm. of the middle tibia 0·53 mm., of the posterior tibia 0·9 mm. The lengths of the tarsal joints in millims. are: in the fore foot, 0·23, 0·05, 0·07; in the mid foot, 0·3, 0·05, 0·07; in the hind foot, 0·44, 0·06, 0·08. The ratio of the hind tarsal joints as $5\frac{1}{2}$: $\frac{3}{4}$: 1. First hind tarsal joint with about 19 ctenidiobothria. Claws (fig. 73) with stout tooth close before the apex; empodial appendix setiform.

Wing membrane hyaline, that of the fore wing very faintly brownish. Both wings rather strongly acuminate. Pterostigma relatively narrow. In the fore wing m_1 discharges over the wing apex. The scales of the fore wing dirty gray-brown to blackish brown with yellowish brown tints. The cover-scales darker, the ground-scales clearer. Shortly before the apex, both at the anterior and at the posterior margin, a somewhat pale very indistinct or hardly perceptible flat spot. Marginal hairs very long, standing off, pale brown. Hind wing with very long and pale marginal hairs; veins pale brown. Only the apical third pubescent. Radial cell very narrow. Membrane deep blue-green to violet and reddish iridescent.

Ground scales (fig. 65 *gs*) fusiform, apex strongly acuminate; cover scales (*ds*) slender, marginal scales (*hrs*) very slender.

Length of fore wing 2·2 mm., wing expanse 5 mm.

Ceylon, Peradeniya. Under dry leaves on the ground, March, 1905, one specimen; under dead bark of tree, May, 1905, one specimen; collected by Mr. E. E. Green.

Perientomum, Hagen., 1865.

Hagen, Ent. Mo. Mag., vol. II., 1865, p. 151; Verh. Zool. Bot. Ges. Wien., 1866, p. 210.

Enderlein, Ann. Mus. Nat. Hung. I., 1903, pp. 320–321.

Type: *P. trichopteryx*, Hag., 1859.

Wings more or less acuminate. The first radial branch (r_1) of the hind wing arises between the origins of m_1, and m_2; only in isolated cases does it arise at the insertion of m_1 (one example each of *P. chrysargyrium*, n. sp., and *P. trichopteryx*, Hag., 1859; *cf.* Hagen, Ent. Mo. Mag., II., 1865, p. 152, under *P. morosum*, Hag., and *Neptiloculomima mortua* (Hag.) in the present work. In the fore wing r_1 (the hinder border of the pterostigma) is fused with the peduncle of the radial fork for a short distance or touches it at one point.

Claws with one tooth before the apex. Scales fusiform with more or less produced apex (figs. 46, 48–50, 67), the cover scales larger and slenderer, sometimes (*P. triste*, Hag.) straight cut at the end (with rounded angles) or faintly emarginate (fig. 63), sometimes also (*P. Greeni*, n. sp.) the ground and cover scales are more or less concave at the end (fig. 53). The three ocelli are far apart from each other. Forehead and vertex with very long and close-set hairs. Antennary joints of the flagellum relatively long. Suture of vertex always distinct.

I think it very probable that the *Thylax madagascariensis*, Kolbe (Berlin, Entomolog. Zeitschr., Bd. XXIX., 1885, p. 184, fig. 1 *a*, *b*, *c*) belongs to the Perientominæ, probably to the genus *Perientomum* or to an allied genus. It seems that Kolbe had before him a specimen from which the scales had been lost. The figures and description are entirely in favour of this assumption. Unfortunately the type has been lost and I therefore leave the question undecided until new material from Madagascar clears it up. (See p. 77, footnote 1).

Table of Species of Perientomum.

1.	Wings very strongly acuminate. Pterostigma narrow. Fore wing brown. Legs brown-yellow	*acutipenne*, n. sp
	Wings moderately acuminate ..	2.
2.	Fore wing silvery and golden, only a narrow marginal seam in the apical half black, silver spotted. Pterostigma broad, basal half silvery, terminal half golden	*chrysargyrium*, n. sp
	Fore wing with dark spots or chiefly dark	3.
3.	Fore wing with dark spots, dark pattern or dark ground interrupted by extensive golden or silver or both golden and silver spots	4.

Fore wing with dark brown to black brown ground with golden or silver marginal spots .. .. 8.

4. Ground silver with brown spots .. 5.
Ground brown or black with golden or silver and golden spots .. 7.

5. Legs brown, trochanters pale brownish yellow, as are also the apices of femora and tibiæ. Wing expanse about 6 mm. Head pale brown .. *argentatum*, n. sp.
Legs yellow, spotted brown or black .. 6.

6. Apices of femora and tibiæ brown. Wing expanse about $7\frac{1}{2}$ mm. Head yellow *trichopteryx* (Hag. 1859).
Upper side of femora, base and a broad band before the apex of the tiibæ and the base of the first tarsal joint black. Head black. Fossil in East Indian copal *incultum*, Hag. 1865.

7. Ground black intermingled with golden and silver scales; two large silver marginal spots at the anterior margin, one at the posterior margin. Legs yellow. Base and apex of tibiæ, basal half of first tarsal joint, and the second and the third tarsal joint black .. *gregarium*, Hag. 1865.
Brown with golden spots and larger golden marginal spots, one between the ends of every two veins. Pterostigma moderately narrow. Legs brown-black, apices of the femora and tibiæ brown-yellow .. .. *Greeni*, n. sp.

8. Marginal spots golden, very small, at the end of each vein. Pterostigma broad. Legs brown-black, extreme apices of femora above and of the tibiæ brownish yellow .. .. *morosum*, Hag. 1865.
Marginal spots silver .. .. 9.

9. Marginal spots large, with offstanding hairs between the vein terminations; five at the anterior and five at the posterior margin. Pterostigma moderately narrow. Legs brown to black-brown. Head brown .. .. *triste*, Hag. 1865.

Two large spots at the anterior margin before the apex; at the hinder margin one such spot at the border of the cubital bifurcation and another at the border of the anal cell. Legs clear brown to brown. Head brown-black . . *ceylonicum*, n. sp.

Perientomum chrysargyrium, n. sp. (Figs. 9, 48, 74, 101).

Head dark brown; very long and compact hair on forehead and vertex, inclined in a bunch below and forwards and having a yellowish brown colour. Eyes dark, large, with short, compact, and relatively stout pubescence. Antennæ thin, about one-half the length of the fore wing, black brown, basal third yellowish brown, with rather close-set and long pubescence. Maxillary palp yellow-brown. Inner lobe of maxilla shown in fig. 101.

Thorax black-brown above, mesonotum with gray-brown, shining scales. Legs more or less dark yellow-brown; femora (except their apices), trochanters, and coxæ clear brownish yellow, likewise the apices of the tibiæ, of the first tarsal joints, and the second tarsal joints. The compact scaling of the femora and tibiæ with a bright, yellowish silken sheen. The length of the anterior tibia is 0·47 mm.; of the middle tibia 0·66 mm.; of the posterior tibia 1·3 mm. The lengths of the tarsal joints in millims. are: in the fore foot, 0·19, 0·05, 0·05; in the mid foot, 0·25, 0·05, 0·06; in the hind foot 0·38, 0·06, 0·06. The ratio of the hind tarsal joints is therefore as $6\frac{1}{3} : 1 : 1$. First hind tarsal joint with about 17 ctenidiobothria. Claws small (fig. 74) with a fairly acute tooth relatively far from the apex and very thin broad empodial appendix, which expands and rounds to a circular form at the end.

Membrane hyaline; pterostigma broad; m_1 discharges close before the wing apex. Scaling of the fore wing in the basal half, with more or less of a silvery lustre, to gray white with silken sheen, behind often with faint coppery hue. Apical half with bright yellow golden, behind at the base a narrower silver seam, the rest of the margin narrowly seamed with sammet black; this black marginal seam is interrupted at the anterior margin by four silvery spots, at the posterior margin by two such spots; marginal hairs of the apical half remarkably long, pale yellowish gray-brown.

Hind wing hyaline, veins pale brown. Marginal hair very long, yellowish gray-brown. The narrow radial cell R is relatively broad. The point of ramification of r_1 lies more or less near to that of m_1, in one case the two points coincide in one of the two wings. Membrane of hind wing intense red iridescent to violet and green.

Ground scales (fig. 48 *gs*) shorter and longer elliptical; cover scales (*ds*) fusiform, marginal scales (*vrs*) usually very narrow.

Length of fore wing 2·4 mm., wing expanse 5½ mm.

Ceylon, Peradeniya. On walls and ceilings of houses. January, 1905, fourteen specimens and twelve examples in alcohol; March, 1905, one specimen; collected by Mr. E. E. Green.

Perientomum gregarium, Hag., 1865.

Amphientomum ceylonicum, Nietner, *in litt.*

A. gregarium, Hagen, Ent. Mo. Mag., II., 1865, p. 149.

Perientomum gregarium, Hagen, Verh. Zool. Bot. Ges. Wien., 1866, pp. 204 and 210.

P. gregarium, Hag., Enderlein, Ann. Mus. Nat. Hung. I., 1903, p. 321.

Ceylon, Hagen, *l.c.* p. 149:

"Head reddish yellow, near the eyes, and on each side of the occipital suture darker, brownish; ocelli close together, the superior placed in a black point; palpi pale yellow, the two apical joints brown; antennæ shorter than the wings, blackish brown; the bases as far as the fourth joint, paler; thorax blackish brown; superior wings clothed with black scales, intermingled with silvery and golden; paler spots near the apex, two quadrangular silvery spots on the anterior margin near the apex, one spot opposite on the posterior margin; legs pale yellow, the tibiæ at the knees and before the apex, as also the basal half of the first tarsal joint and the two following, black.

Long. 2¾–3½ mm., exp. alar. 5½–7 mm.

Ceylon. Rambodde (Nietner). This species is found in troops of forty to fifty on the walls of houses. In two smaller individuals, probably males, the part between the eyes (which are more prominent) is narrower."

Perientomum Greeni, n. sp. (Figs. 10, 51–53, 71).

Head black; moderately long and compact hair on forehead and vertex; the hair is curved upwards above and downwards below; its colour is black-brown, with individual yellow-brown hairs. Eyes large, black, with very short, fine, and close pubescence. Antennæ thin, about one-half the length of the fore wing, black, pubescence relatively sparse and short. Maxillary palp black.

Thorax black, mesonotum behind and at the sides with golden scales. Legs brown-black, apices of the femora and tibiæ brown-yellow. Scales of femora and tibiæ gray yellowish with silken gloss,

The length of the anterior tibiæ is 0·54 mm.; of the middle tibiæ 0·6 mm.; of the posterior tibiæ 1 mm. The lengths of the tarsal joints in millims. are: in the fore foot 0·22, 0·06, 0·07; in the mid foot 0·3, 0·06, 0·07; in the hind foot 0·42, 0·08, 0·08. The ratio of the hind tarsal joints is therefore as $5\frac{1}{4}$: 1 : 1. First hind tarsal joint with about 17 ctenidiobothria. Claws (fig. 71) with stout tooth fairly distant from the apex and sharp basal angle; empodial appendix setiform.

Wing-membrane hyaline. Pterostigma (fig. 52) rather narrow; m_1 discharges into the wing-apex. Scales of fore wing brownish black with golden mottling (fig. 10). The ground scales are shining gray, the large cover scales dull and very dark. The golden spots are distributed as follows:—Hinder border with 6 marginal spots between the ends of the veins; the first of these spots (at the end of the first quarter of the wing) is drawn out to a narrow interrupted cross band; anterior border with 4 marginal spots between the ends of the veins, of which the first is again produced as a several times interrupted cross band which ends at the third posterior marginal spot; between these spots occur irregularly disposed smaller spots. Wing base golden, likewise the space between anterior margin and subcosta. Marginal pubescence moderately long, brown, at the golden spots yellowish and shining golden. Hind wing with narrow radial cell; r_1 arising midway between m_1 and m_2. Marginal hair long, pale brown. Membrane red violet iridescent to intense green.

Ground scales (fig. 53 *gs*) ovate, somewhat concave at end or rarely straight cut; cover scales attenuating towards the base, broad at the end, truncate with faint shallow concavity; marginal scales (fig. 51 *rs*) fusiform, border with fine microscopic serrations; macrochætæ (fig. 51 *mch*) tuberculate dentate in the apical half.

Length of fore wing 2·4 mm. wing expanse $5\frac{1}{2}$ mm.; Ceylon. Peradeniya; on tree trunk, February, 1905, one specimen, collected by Mr. E. E. Green.

Perientomum argentatum, n. sp. (Figs. 14, 50, 75).

Head pale brown; the long close-set hair on forehead and vertex is silver white, inclined downwards on the forehead, upwards on the vertex. Eyes brown, with very short, fine, and extremely compact sammet-like pubescence. Antennæ thin, about one-half length of fore wing, clear brown becoming gradually darker towards the apex;

pubescence rather long and moderately compact. Clypeus moderately convex with fine silver gray hairs. Labrum smooth shining dark brown. Maxillary palp brownish yellow, apical third of the end joint dark brown.

Thorax brown, mesonotum covered with silver white scales. Legs brown, the following parts pale brownish yellow :—Trochanters, usually also the base of the femora, apex of the femora and of the tibiæ. Scales of the femora, especially above at the apex, silver white. The length of the anterior tibia is 0·4 mm., of the middle tibia 0·54 mm., of the hind tibia 1 mm. The lengths of the tarsal joints in the fore foot, 0·16, 0·05, 0·06 mm. ; in the middle foot, 0·25, 0·05, 0·06 mm. ; in the hind foot 0·4, 0·06, 0·07. The ratio of the hind tarsal joints is therefore as $5\frac{5}{7} : \frac{6}{7} : 1$. First hind tarsal joint with about 16 ctenidiobothria. Claws (fig. 75) long and slender, with acute tooth rather far before the apex and a feeble tooth rudiment in the middle between this and the setiform empodial appendix.

Wing membrane hyaline. Pterostigma (fig. 14) broad and large. The pattern of the fore wing produced by the scaling is shining silvery gray-white with brown to gray-brown markings. The markings are distributed as follows :—On all the ends of the veins occurs a spot, those of the posterior margin larger ; through the middle of the axillary cell a narrow band passes obliquely outwards from the posterior margin to the anterior margin without however quite reaching the latter ; with this band the marginal spots at the ends of *an* and cu_2 are connected ; the marginal spot at the end of cu_1 communicates with a larger irregular spot in the wing centre, which encloses a small round silver white spot ; the marginal spots of the wing apex also partly anastomose among themselves. In the middle of the wing base a brown spot. Marginal hair relatively short, yellowish white, blackish at the brown spots. Hind wing with narrow radial cell (*R*) ; r_1 near the base of *cu*. Veins brown. Marginal hair of the anterior border relatively short and brown, that of the posterior border long and yellowish white. Membrane intensely iridescent in all colours.

Ground scales (fig. 50 *gs*) longish ovate, almost imperceptibly acuminate at the apex ; cover scales (*ds*) similar, though slenderer in the basal portion. Macrochætæ (fig. 50) finely pubescent in the distal half.

Length of fore wing 2·3 mm. ; wing expanse $5\frac{1}{4}$ mm.

Ceylon Peradeniya, on tree trunks ; January, 1905, two specimens ; February, 1905, two ; March, 1905, two ; collected by Mr. E. E. Green.

Perientomum trichopteryx (Hag., 1859).

Amphientomum trichopteryx, Hagen. Verh. Zool. Bot. Ges. Wien., 1859, p. 205.

Perientomum trichopteryx, Hagen. Ent. Mo. Mag., II., 1865, pp. 151 and 152 (notice under P. mortuum, Hag.).

Amphientomum trichopteryx, Hagen. Verh. Zool. Bot. Ges. Wien., 1866, p. 204.

A. trichopteryx, Hag., Kolbe. Einf. Kenntn. d. Ins., 1893, p. 44, fig. 43.

A. trichopteryx, Hag., Enderlein. Ann. Mus. Nat. Hung., Bd. I., 1903, pp. 311 and 325 (notice in Hagen's description of P. mortuum, Hag.).

Ceylon.

Although the "Psocinorum Syropsis synonymica" of Hagen (1866) appeared one year later than the work quoted above "On some Aberrant Genera of Psocina" (Ent. Mo. Mag., II., 1865, pp. 148–152), which was published in December, 1865, there seems to be no doubt that the former was compiled earlier; and the second work was only referred to by notes in the first review which Hagen made incorrectly and forgot to correct later. Otherwise the confusion as to the position of *P. trichopteryx* is unintelligible.

There is thus no doubt that *P. trichopteryx*, Hag., represents the type of the genus *Perientomum*, Hag., since Hagen introduces this species in the first place after the generic diagnosis (*l.c.*, *p.* 151).

It is also certain from Hagen's note under *P. mortuum*, Hag. (*l.c.* 1865, p. 152), that *P. trichopteryx* does not belong to the new genus *Nepticulomima* (*cf. N. mortua*, Hag., 1865, in the present work).

Perientomum morosum, Hag., 1865 (Figs 11, 47, 49, 69). P. morosum, Hagen., Ent. Mo. Mag., II., 1865, p. 152.

Amphientomum morosum, Hagen. Verh. Zool. Bol. Ges. Wien., 1866, p. 204.

(*non* Perientomum morosum, Enderlein. Ann. Mus. Nat. Hung., Bd. I., 1903, p. 323. *Cf.* chrysochlorum, n. sp.).

Head brown. On forehead and vertex moderately long (relatively short) hair; in the middle this is black, above and below brownish yellow, with silken gloss; that of the vertex is directed upwards in the middle vertical, somewhat combed towards the sides, the rest upright. Antennæ very thin, short, about one-half length of fore wing, black, the two basal joints brown; pubescence relatively sparse and short. Eyes black, shortly, closely, and stoutly pubescent. Maxillary palp brown, end joint black.

Thorax black, mesonotum with brown black scales. Legs brown-black, extreme apices of the femora above and of the tibiæ brownish yellow. Scaling of the femora and tibiæ with brown silken lustre. Length of the anterior tibia 0·52 mm., of the middle tibia 0·6 mm., of the posterior tibia 1·05 mm. Lengths of the tarsal joints in the fore foot 0·21, 0·06, 0·07 mm.; in the middle foot 0·27, 0·06, 0·07 mm.; in the hind foot 0·4, 0·08, 0·08 mm. The ratio of the hind tarsal joints as 5 : 1 : 1. First hind tarsal joint with about 19 ctenidiobothria. Claws long and slender (fig. 69), with stout tooth before the apex, basal angle rounded; empodial appendix setiform.

Wing membrane hyaline. Fore wing with broad pterostigma (fig. 47); m_1 ends close behind the wing apex. Scaling black-brown (cover scales); the ground scales gray-brown, with silken sheen; at the ends of the veins occur small, triangular yellow golden spots, at the anterior margin four, at the posterior margin seven (of which the third occurs *between* the ends of cu_1 and cu_2). Marginal hair moderately long, brown, at the golden spots yellow, with golden lustre. Hind wing with relatively very broad radial cell; r_1 in the middle between m_1 and m_2. Marginal hair long, pale brown. Veins brown. Membrane iridescent green to red violet.

Ground scales (fig. 49 *gs*) fusiform, end acuminate; cover scales (*ds*) elongate fusiform, expanding towards the end which is acuminate.

Length of fore wing 2·2 mm., wing expanse 5 mm.

Ceylon. Maskeliya. April, 1905, on the stem of a bamboo tree; one specimen, collected by Mr. E. E. Green.

Perientomum triste, Hagen., 1865 (Figs. 12, 62, 63, 70).

P. triste, Hagen., Ent. Mo. Mag., II., 1865, p. 152.

Amphientomum triste, Hagen. Verh. Zoo. Bot. Ges. Wien., 1866, p. 204.

Perientomum triste, Hagen, *l.c.*, p. 210.

(*nec*: P. triste, Enderlein. Ann. Mus. Nat. Hung., Bd. I., p. 325, *cf.* P. ceylonicum, n. sp.).

Head brown, forehead and vertex with close and moderately long pubescence, brown to black-brown. Eyes large, black, with short, close, and fine pubescence. Antennæ thin, black, about one-half length of fore wing, pubescence moderately close-set and rather long. Maxillary palp black.

Thorax black, mesonotum with dark gray-brown. scaling. Legs brown to black brown. The length of the anterior tibia is 0·46 mm.; of the middle tibia 0·54 mm.; of the posterior tibia 0·9 mm; The lengths of the tarsal joints in the middle foot 0·26, 0·6, 0·07 mm.

in the hind foot 0·4, 0·08, 0·07 mm. The ratio of the hind tarsal joints as 5 : 1 : $\frac{7}{8}$. First hind tarsal joint with about 16 ctenidiobothria. Claws (fig. 70) slender, with an acute tooth before the apex ; empodial appendix setiform.

Wing membrane hyaline. Fore wing with moderately broad pterostigma (fig. 62) ; m_1 almost discharges into the wing apex, only a trace before it. Scaling blackish brown (cover scales), the ground scales are more gray and somewhat shining. On both the anterior and posterior margins there are five moderately large roundish silver spots, upon which, besides the scales, long silvery fairly erect hairs are inserted, directed at a very steep angle towards the margin ; the innermost spot at the anterior margin lies at the end of the subcosta, the innermost at the posterior margin lies at the end of the analis ; the other spots lie between the ends of the veins. Marginal hair rather long, blackish brown. The narrow radial cell (*R*) in the hind wing fairly broad ; r_1 inserted somewhat near to m_1 ; marginal hair long ; membrane iridescent green to red.

Ground scales (fig. 63 *gs*) fusiform, acuminate at the end ; cover scales (*ds*) long, with nearly parallel sides, only slightly attenuating towards the base, the end truncate with strongly rounded angles or shallowly concave likewise with rounded lateral angles.

Length of fore wing 2·3 mm ; wing expanse $5\frac{1}{4}$ mm.

Ceylon. Peradeniya. March, 1905, under loose bark on stems of *Artocarpus integrifolia* ; two specimens, collected by Mr. E. E. Green.

Perientomum ceylonicum, n. sp. (figs. 13, 45, 46). Perientomum triste, Hag. Enderlein. Ann. Mus. Nat. Hung. I., 1903. p. 325. Taf. XIII.; figs. 65–65 *a*. Text fig. 11.

Head brown-black, beset with fairly compact and long brownish gray hairs. Occiput compressed lamelliform, margin fairly sharp. Eyes gray-brown, closely and shortly hairy, little larger than in *P. morosum*, Hag. Antennæ brown, short and thin, 21 joints (complete) ; with sparse, moderately long and setiform hairs, the separate joints moderately long, shorter towards the end, the last joint about three or four times as long as broad. Each joint shows, with strong microscopic magnification, a very fine pubescence disposed in close-set rings. Ocelli far distant from one another.

Prothorax short but broad. Thorax and abdomen brown. Legs clear brown to brown. Femora thickly scaled as in *P. morosum*, Hag., and beset with fine long hairs. Tibiæ, especially the hinder tibiæ, thickly beset with narrower scales and with scattered, long,

thick, yellow setæ. Tarsi without scales. First hind tarsal joint with close-set and short setæ, with 20 ctenidiobothria, which however are composed of very delicate pale yellow hairs and so do not strike the eyes of the observer. Second hind tarsal joint without perceptible ctenidiobothria; the hairs may be so fine and short that they do not stand out from the fine pubescence of this joint. Third hind tarsal joint with only three long hairs at the end of the outer side, otherwise with extremely short, fine, and fairly compact pubescence. Claws long, narrow and acute, a stout tooth near the apex. Empodium with a seta on each side. Ratio of the hind tarsal joints as $5 : 1 : \frac{3}{4}$.

Fore wing brown, closely beset with symmetrical scales bluntly acuminate in front, and amidst these long, thin, curved hairs, the latter occurring especially on the apical half and here particularly on the veins. Scales gray-brown to brown, intermingled with silvery scales; a streak in the costal cell, a marginal spot in each of cells R_1, R_{2+3}, Cu_1 and An with perfect silver lustre. Analis with hyaline seam. The hinder portion of the wing base is formed by a smooth pale brown area which carries about 27 hair cupules but is without hairs. The area between costa and subcosta pale brown, strongly thickened and chitinised, scaleless, with only individual long erect setæ; most of the setæ are relatively short and recumbent. Only the margin of the outer wing half with very long close-set and delicate hairs; the hairs inserted upon long stalked cupules arranged in cross rows. The rest of the anterior margin only shortly pubescent, still the single hairs are faintly expanded, scale like. The radial branch (r_1) of the pterostigma unites for a short distance with the peduncle of the radial fork, the radial ramus for a fairly long distance with the media. The radial fork nearly $1\frac{1}{2}$ times the stalk length; peduncle of the cubital fork $\frac{1}{2}$ of cu_2 and $\frac{1}{4}$ of cu_1. Stigma sac occurs as a strong tracheal expansion at the base of that portion of the subcosta which abuts upon the pterostigma, with many irregular, torn, and separated parts of the tracheal spirals.

Hind wing brownish hyaline; veins and membrane of the apical half fairly closely pubescent. Wing border with exception of the anterior margin of the costal cell with very long and compact hair. The two branches of the media without stalk. The portion of r which bounds the extremely narrow radial cell R in front is somewhat curved, with a little sharp trachea, expanded and represented by a fairly broad brown pigment seam.

Membrane of the hind wing in certain lights intensely iridescent deep red, red violet to blue, partly with deep black lustre The

wing scales are shown in fig. 46 (*ds* = cover scale, *gs* = ground scale. *rs* = marginal scale).

Length of fore wing 3 mm., wing expanse 6½ mm.

Ceylon. Pattipola, 2,000 metres, February 22, 1902, one female (Biró coll.).

Perientomum acutipenne, n. sp. (Figs. 66, 67, 72).

Head reddish brown, occiput very pale; hair of forehead and vertex erect, moderately long, brown. Eyes red-brown, pubescence moderately compact, very short but stout. Antennæ reddish brown, about three-fourths length of fore wing, very long and sparsely pubescent. Maxillary palp brown-yellow, apex of end joint brown.

Thorax brown. Mesonotum covered with gray-brown shining scales. Legs brown-yellow. The length of the anterior tibiæ is 0·6 mm.; of the middle tibiæ 0·64 mm.; of the posterior tibiæ 1·05 mm. The lengths of the tarsal joints in the fore foot are 0·27, 0·07, 0·08 mm.; in the middle foot 0·35, 0·07, ?; in the hind foot 0·5, 0·08, 0·09. The ratio of the hind tarsal joints is therefore as $5\frac{1}{2} : \frac{8}{9} : 1$. First hind tarsal joint with about 22 ctenidiobothria. Claws (fig. 72) slender; tooth close before the apex, stout and acute; empodial appendix setiform.

Wings very narrow and strongly acuminate. Membrane hyaline; veins very pale brownish; pterostigma rather narrow (fig. 66). The scaling of the fore wing brown with faintly reddish tint and gray lustre. Marginal hair very long and strongly discrete, that of the anterior margin pale reddish brown, that of the hinder margin gray-black. The radial cell (*R*) of the hind wing very narrow. Marginal hair long and coloured as in the fore wing. Hind wing brightly iridescent blue green to violet.

Scales of fore wing fusiform, apex acuminate. Ground scales (fig. 67 *gs*) shorter, cover scales (*ds*) longer. Marginal scales (*hrs*) slender, but in part very broad.

Length of fore wing 2·5 mm., wing expanse, 5½ mm.

Ceylon, Maskeliya; under dead bark of tree. April, 1905, one specimen, collected by Mr. E. E. Green.

Perientomum incultum, Hag., 1865.

Amphientomum incultum, Hagen. Ent. Mo. Mag. II., 1865, p. 149.

A. lepidopterum, Hagen. Verh. Zool. Bot. Ges. Wien, 1866, p. 204.

Perientomum incultum, Hagen, *t.c.* pp. 204 and 211. P. incultum, Hag., Enderein. Ann. Mus. Nat. Hung. I., 1903, p. 322. Fossil in East Indian copal.

Nepticulomima, n. g.

(Type: *N. Sakuntala*, n. sp.)

Wings more or less acuminate. The first radial branch (r_1) in the hind wing arises between the origins of m_1 and r_{4+5}. In the fore wing, r_1 is fused with the peduncle of the radial fork over a short stretch or in one point.

Claws with one tooth before the apex. Antennæ, in *N. Sakuntala*, 24-jointed (fig. 125). Scales fusiform (figs. 83, 87, 91), ovate (fig. 85), spatuliform with more or less straight-cut or faintly concave end (fig. 89), the cover scales larger and slenderer. The three ocelli far apart from one another. Forehead and vertex with very long and closely placed hairs. Antennary joints relatively long.

TABLE OF SPECIES.*

1. Fossil in the copal of Zanzibar .. *mortua* (Hag. 1865).
   Recent .. .. 2.
2. Scales spatuliform. Head polished smooth, very shortly and sparsely hairy. Scaling of fore wing brownish black with deep metallic green lustre. Legs uniformly yellow-brown, apices of the femora brown above. Head brown *chalcomelas*, n. sp.
   Scales fusiform or ovate. Head dull, pale brownish; long and closely hairy .. 3.
3. Fore wing brown or gray-brown, with extensive silvery or brass-coloured marking .. .. 4.
   Fore wing yellow-brown or gray-brown with small straw yellowish marginal spots between the ends of the veins .. 5.
4. Fore wing dark brown with brass yellow spots with metallic lustre, and transverse streaks; at the end of the basal third a moderately broad very dark brown cross band. Legs black-brown; the following parts pale brownish yellow:—Trochanters, a broad band before the apex of the femora, a narrower ring at the end of the first third of the tibia, apex of the tibia, distal half of the first tarsal join and last tarsal joint .. .. *Essigkeana*, n. sp.

* *N. biroiana.*, Enderl., 1903, is not included in this table.

Fore wing relatively narrow ; gray-brown with large silvery marginal spots between the ends of the veins, which, in part, expand to large spots extending into the wing centre. Legs reddish brown-yellow, femora pale brownish yellow .. .. *Sakuntala*, n. sp.

5. Fore wing gray-brown ; the three marginal spots of the hinder border roundish. Ocelli large, the space between one of the posterior ocelli and the eye-border is much less than one-third of the distance between a posterior ocellus and the anterior .. .. *Hosemanni*, Enderl. 1903.

Fore wing yellow-brown ; the three marginal spots of the hinder border flat and applied to the border. Ocelli small ; the space between a posterior ocellus and the eye-border is about one-third of the distance between a posterior ocellus and the anterior .. .. *brasiliensis*, Enderl. 1906.

Nepticulomima Sakuntala, n. sp. (Figs. 20, 77, 82, 83, 117, 125).

Head pale brownish yellow, clypeus with faint reddish tint, labrum brown to pale brown. On forehead and vertex long hair pale brownish yellow to pale brownish, that of the vertex directed upwards in a tuft and somewhat curved backwards. Eyes large, dark red-brown to black, pubescence moderately close but relatively long and stout. Antennæ (fig. 125) thin, about two-thirds the length of the fore wing, pubescence moderately compact and fairly long ; 24-jointed (complete). The lengths of the antennary joints in millims. are : 0·05, 0·07 (basal joints) ; 0·07, 0·09, 0·08, 0·08, 0·07, 0·06, 0·07, 0·06, 0·06, 0·05, 0·05, 0·04, 0·06, 0·06, 0·06, 0·08, 0·06, 0·06, 0·07, 0·08, 0·08, 0·07. Maxillary palp brownish yellow, end joint somewhat brownish.

Thorax clear brownish yellow ; mesonotum thickly beset with clear brownish yellow scales giving a strong silken glitter. Femora pale brownish yellow, tibiæ and tarsi reddish brown-yellow. The compact scaling of femora and tibiæ, strong brownish yellow with silken lustre. The length of the anterior tibia is 0·52 mm. ; of the middle tibia 0·63 ; of the hinder tibia 1·08 mm. The lengths of

the tarsal joints in the fore foot are : 0·23, 0·05, 0·06 mm. ; in the middle foot 0·32, 0·06, 0·07 mm. ; in the hind foot 0·43, 0·07, 0·07 mm. The ratio of the hind tarsal joints is therefore as 6 : 1 : 1. First hind tarsal joint with about 20 ctenidiobothria. Claws (fig. 77) slender, with thin apex and stout tooth rather far before the apex ; empodial appendix setiform. Hind leg represented in fig. 117.

Wings relatively narrow, acuminate. Wing membrane hyaline. Pterostigma rather narrow (fig. 82) ; m_1 enters precisely into the wing apex. Scaling of fore wing brown (cover scales), ground scales pale brown-yellow with strong silken lustre. At the margin between every two vein terminations large silvery to silken spots, likewise the distal half of the axillary and anal cells. The marginal spot between m_3 and cu_1 expands to a large acute angled triangle, which extends to the wing centre, its apex being directed towards the wing base (fig. 20). Marginal hair long and brown. Hind wing with moderately narrow radial cell (R) ; veins pale brown ; marginal hair (pubescence) long and brown, at the hinder border very long ; membrane of the apical half pubescent ; r_{4+5} ends exactly in the wing apex ; membrane strongly iridescent green to red.

Ground scales (fig. 83) somewhat ovate with the acuminate end strongly set off. Cover scales (*ds*) elongate with stout apex. Marginal scales (*vrs*) slender, fusiform.

Length of fore wing 2·6 mm., wing expanse 6 mm.

Ceylon. Peradeniya, under papers in a room ; January, 1905, four specimens ; February, 1905, two specimens, collected by Mr. E. E. Green.

Nepticulomima Essigkeana, n. sp. (Figs 17, 79, 84, 85).

Head pale brownish yellow ; small brown spots occur at the suture of the vertex, a row of 3 or 4 on each side approximately parallel to the inner eye-border, at the base of the antennæ, 2 on the forehead. The base of the ocelli and the upper lip are also brown. Clypeus sometimes faintly brownish. The long hair on forehead and vertex pale brown-yellow and shaggy. Eyes spherical, black-brown, pubescence stout, moderately compact and relatively long. The ocelli are placed far apart, and are arranged in a very flat triangle, so that the distance between the two posterior ocelli is almost twice as great as that between the anterior and a posterior ocellus ; the latter distance is more than twice as great as the space between a posterior ocellus and the eye-border. Antennæ pale brownish yellow, becoming gray towards the apex ; the anterior side of the two (in this species) very greatly developed basal joints brown.

Pubescence fairly long but tolerably compact. Maxillary palp clearer or darker brown-yellow, apex somewhat darker.

Thorax pale brownish, mesonotum covered with clear brownish yellow scales which give a brass-yellow lustre. Legs black-brown, the following parts pale brownish yellow :—Trochanters, a broad band before the apex of the femora, a narrower ring at the end of the first third of the tibiæ (in the hind tibiæ more towards the middle), apex of the tibiæ, distal half of the first tarsal joint (in the hind tarsi two-thirds of the length), and the last tarsal joints. On the upper side of the hind tibiæ six of the long seta are arranged in a longitudinal row and attain a considerable length, standing nearly parallel in an angle of about 45°. Scaling of the femora and tibiæ with yellowish silken lustre. The length of the middle tibia is 0·56 mm. ; of the hind tibia 0·97 mm. The lengths of the tarsal joints in the middle foot are : 0·25, 0·05, 0·05 ; in the hind foot 0·38, 0·05, 0·06. The ratio of the hind tarsal joints is therefore as $6\frac{1}{3} : \frac{5}{6} : 1$. First hind tarsal joint with about 18 ctenidiobothria. Claws (fig. 79) slender, tooth rather far before the slender apex ; empodial appendix in the form of a narrow dermal ribbon strongly acuminate towards the apex.

Wing membrane hyaline ; pterostigma moderately broad ; m^1 discharges shortly before the wing apex. The wing pattern produced by the scaling is as follows :—Ground colour dark brown ; a pale brass-coloured and shining marking, consisting of smaller and larger spots, marginal spots, and interrupted cross bands, is distributed almost over the entire wing, attaining special development in the basal third of the wing ; only a moderately broad, very dark brown cross band, which occurs at the end of the basal third, is free from brass-coloured scales. To this cross band is applied a narrower brass-coloured cross band scarcely interrupted by a few brown scales. Marginal hair moderately long, black-brown, at the brass-coloured marginal spots clear brownish yellow. Hind wing with relatively broad radial cell (*R*) ; marginal hair very long, pale brownish ; veins clear brown ; membrane intensely iridescent violet to red, passing in some places to green.

Ground scales ovate (fig. 85 *gs*), cover scales (*ds*) longish to elongate elliptical, at the end round or barely perceptibly truncate, still rounded. Marginal scales as in the other species.

Length of fore wing, 2·3 mm ; wing expanse $5\frac{1}{4}$ mm.

Ceylon. Peradeniya ; on the outer surface of walls, January, 1905, one specimen ; March, 1905, one specimen, collected by Mr. E. E. Green.

I have dedicated this species to my friend Mr. Walther Essigke of Limbach near Chemnitz.

Nepticulomima brasiliensis, Enderl., 1906. (Figs. 19, 78, 86, 87).

Perientomum brasiliense, Enderlein. Zool. Jahrb. Syst., vol. 24, 1906, p. 88.

Head brown-yellow ; hair of forehead and vertex brownish yellow with silken sheen, compact and moderately long. In the place of the suture of the vertex occurs a faintly raised longitudinal keel. Ocelli small, black, bead-like, the ocellar triangle is fairly flat ; the distance of a posterior ocellus from the eye-border is about one-third of the space between a posterior ocellus and the anterior. Occipital edge sharp, in the middle shallowly emarginate. Eyes hemispherical, black ; pubescence moderately short and fairly stout. Maxillary palp, brown-yellow, end joint slightly darker.

Thorax brown yellow ; mesonotum with clear brownish-yellow scales, with strong silken lustre. Legs brown-yellow ; the scaling of the femora and tibiæ clear brownish yellow with silken lustre ; from the ground colour the tarsi appear somewhat darker. Length of hind tibia 1·08 mm. The lengths of the hind tarsal joints are 0·38, 0·06, 0·06 mm. The ratio of the hind tarsal joints is therefore as $6\frac{1}{3} : 1 : 1$. First hind tarsal joint with about 22 ctenidiobothria. Claws (fig. 78) with slender apex, a stout tooth before the apex ; empodial appendix setiform ; base broad.

Membrane of fore wing hyaline, with faint brownish tinge. Pterostigma narrow (Fig. 86) ; m_1 discharges close before the apex. The scaling is yellow-brown with silken lustre ; in the apical half four moderately sharp marginal spots occur at the anterior border, three at the posterior (the latter rather flat) of straw yellow colour with silken sheen. Marginal hair tolerably short, brown-yellow, at the clearer places straw yellow. Hind wing hyaline, veins pale brown ; marginal hair very long, pale brown, that of the apical half of the anterior border dark brown. Membrane intensely iridescent red to golden, at the base iridescent in all colours.

Ground scales (fig. 87 *gs*) fusiform with apex slightly or not pronounced. Cover scales (*ds*) elongate fusiform, apex not set off.

Length of fore wing 2·2 mm, wing expanse 5 mm.

Brazil. Pará, November 28, 1893. One specimen, in the collection of the Stettin Museum.

Nepticulomima Hösemanni, Enderl., 1903 (Figs. 18, 90, 91, 110).

Perientomum Hösemanni, Enderlein. Zool. Jahrb. Syst., Bd. XXIX., 1903, p. 3, Taf. I., figs 1–9.

Head brownish. Antennæ brownish, with sparse and fairly long hair ; more than 24 joints. Eyes large, black, pubescent. Suture of

vertex rather well defined. Forehead not separated from vertex. Ocelli large, the two posterior fairly close to the inner eye-borders, their distance from these being much less than one-third of the space between posterior ocelli and anterior ocellus (as is the case in *N. brasiliensis*, Enderl.). Maxillary palp pale brownish.

Thorax pale brown, mesonotum scaly. Legs brown-yellow. Ratio of the hind tarsal joints as 6 : 1 : 1. First hind tarsal joint with about 24 ctenidiobothria. Claws slender, a stout and acute tooth rather far before the apex. Empodial appendix setiform. The abdominal apex of the female with gonapophyses and appendices anales (*aa*) is reproduced in fig. 110.

Membrane of fore wing hyaline, with brownish tinge, especially in middle. Veins brown. Pterostigma fairly narrow; m_1 ends before the apex. Scaling gray-brown, margin of the apical half darker and in front with four small straw-yellowish spots, behind with three, the latter very small and roundish. Marginal hair fairly long, brown, at the clear spots straw-yellowish. Hind wing hyaline, veins pale brown; marginal hair pale brown and very long.

Ground scales fusiform; end acuminate, sharply and distinctly defined (fig. 91 *gs*); likewise in regard to the much larger cover scales (*ds*).

Hind wings brightly iridescent in all colours, especially red and yellow-red.

Length of forewing 2·4 mm., wing expanse 5½ mm.; length of body 2 mm.

Cameroon. Nojoko Station; four females, collected by Staff Surgeon Dr. Hösemann (Types).

Cameroon. Bipindi. October–December, 1898; one specimen, collected by Zenker.

The last specimen was well preserved in regard to the scales, in contrast with the earlier material which was preserved in alcohol. I have supplemented the diagnosis from it.

Nepticulomima chalcomelas n. sp. (Figs. 21, 76, 88, 89, 99).

Head polished smooth, shining dark brown: clypeus and labrum dark brown. The hair upon forehead and vertex is, in comparison with all other species, unusually scanty and short, but still always fairly long and shaggy; its colour is black-brown with gray lustre. Occipital edge particularly sharp, in the middle somewhat emarginate; this emargination is the remains of the suture of the vertex, which is otherwise not perceptible. Also the suture between vertex and forehead has completely vanished. Ocelli very small, shining like

orange yellow glass beads; the distance of the anterior ocellus from one of the posterior ocelli is equal to the space between the latter and the eye-border; the ocellar triangle is moderately flat, the angle at the apex being about 120°. Eyes brown-black, pubescence extremely short and very delicate. Antennæ relatively long, thin, approximately equal to the length of the fore wing; pubescence moderately long and tolerably compact; black-brown, the two basal joints brown; the antennal flagellum has 19 joints (complete) having the following lengths in millims. 0·15, 0·14, 0·16, 0·14, 0·1, 0·1, 0·08, 0·09, 0·09, 0·08, 0·08, 0·09, 0·09, 0·09, 0·09, 0·08, 0·07, 0·07, 0·07, 0·07. Maxillary palp (fig. 99) brown, end joint dark brown.

Thorax dark brown, mesonotum covered with brownish black scales, which mostly give a greenish lustre, certain of them frequently reddish. Legs evenly yellow-brown, femoral apices brown above. The setæ of the hind tibiæ relatively short and scanty. Scales of the femora and tibiæ dull yellowish with silken lustre. The length of the anterior tibia is 0·48 mm.; of the middle tibia 0·6 mm., of the posterior tibia 0·96 mm. The lengths of the tarsal joints in the fore foot are 0·24, 0·06, 0·07 mm.; in the middle foot 0·25, 0·06, 0·07 mm.; in the hind foot 0·37, 0·08, 0·08. The ratio of the hind tarsal joints is therefore $4\frac{5}{8} : 1 : 1$. The first hind tarsal joint with about 14 ctenidiobothria. Claws (fig. 76) very large and slender, tooth before the apex stout and acute; empodial appendix long and setiform.

Membrane of fore wing faint brownish gray hyaline; pterostigma rather narrow (fig. 88); m_1 enters the wing apex. The scaling is brownish black, with deep green metallic lustre: certain scales give also frequently a deep red metallic lustre. Marginal hair moderately long, black, with green metallic lustre. Hind wing hyaline, veins pale brown. Radial cell, *R*, relatively broad. Marginal hair long, pale brownish. Membrane intense red violet, iridescent red to golden, at the wing base iridescent green to blue.

Ground scales (fig. 89 *gs*) spatuliform, end broad and straight-cut or very faintly and shallowly emarginate: angles rather sharp. Cover scales (*ds*) similar, but much longer.

Length of fore wing 2·3 mm.; wing expanse $5\frac{1}{4}$ mm.

Ceylon. Peradeniya; on rotten wood on the ground; March, 1905, 15 specimens collected by Mr. E. E. Green.

Nepticulomima Biroiana, Enderl., 1903.

Perientomum Biroianum, Enderlein. Ann. Mus. Nat. Hung. I., 1903, p. 327. Taf. XI., f. 60b; Taf. XII., f. 60a and c.

The whole body clear yellow-brown. Head with compact and long hair. The three ocelli standing far apart, yellow, finely rimmed with black brown. Sutures distinct. Upper lip gray-brown, clypeus small, very faintly convex; clypeolus rudimentary. Eyes fairly large, finely pubescent, black. Occipital margin rather sharp angled.

Legs likewise clear yellow-brown up to the claws. Tibiæ, especially the hind tibiæ, with long setæ. The spiny comb of each seta of the inner setigerous row of the first tarsal joints little distinct, clear yellow-brown. First hind tarsal joint compactly but rather finely setigerous. Ratio of the hind tarsal joints as 5 : 1 : 1.

Fore wing pale brown, thickly beset with clear brownish scales. As the scales are much rubbed away the pattern of the fore wing cannot be recognised. Hind wing hyaline, colourless, with scanty but long hairs on the margin, on the veins of the apical half and the membrane. In the fore wing m_1, in the hind wing r_{4+5} enter exactly into the wing apex.

Length of fore wing $2\frac{1}{4}$ mm.; wing expanse 5 mm.

German New Guinea (northern portion). Lemien in Berlinhafen, one female (Biró coll.).

Nepticulomima mortua (Hagen, 1865); (*cf.* page 77, footnote 1.)

Perientomum mortuum, Hagen. Ent. Mo. Mag. II., 1865, p. 152. Nepticulomima mortua (Hag.), m.

"This species is similar to P. trichopteryx in form, size, and colouring. Thus I should not have separated it, but for a difference in the details of the venation. In the inferior wings the transverse vein on the anterior margin is emitted from the superior branch (1), while in *P. trichopteryx* it is emitted before the point whence this branch departs.

"I admit that this difference alone is perhaps too slight to justify the formation of a distinct species, especially as in one individual out of five of *P. trichopteryx* now before me, the transverse vein is emitted precisely from the point of departure of the superior branch (1); but as the determination of insects in copal is always rather difficult, I have thought it best to note the species as distinct until more material shall prove to the contrary.

"In gum copal (Animé), from Zanzibar. One specimen, received from Baron Osten-Sacken."

The description of the venation of the hind wing renders its position in the genus *Nepticulomima* certain.

Sub-fam. Lepidopsocinæ.

Enderlein. Ann. Mus. Nat. Hung. I., 1903, p. 208.

After I have eliminated the genus *Echinopsocus*, Enderl., 1903, from this sub-family, there remain for it the following characteristics.

Fore wing with long macrochætæ not only upon the costal area, but also on the veins and sometimes also on the membrane of the marginal seam. Radial ramus forked, united or fused with the pterostigma by cross vein; pterostigma moderately large and relatively flat. Hind wing without radial cell (without a closed cell), otherwise normal. Radial ramus of fore wing forked. Wing scales are all asymmetrical (fig. 107). Antennæ more than 30-jointed (Echmepteryx) to 47-jointed (Lepidopsocus); the antennary joints of the flagellum are very short (antennæ moniliform) or at most about twice as long as thick.

Table of Genera of Lepidopsocinæ.

The radius developed up to the pterostigma. Between pterostigma (branch r_1) and radial ramus a cross-vein .. *Echmepteryx*, Aaron 1886.

(Type: E. Hageni Pack. 1870).

The radius up to the pterostigma completely reduced. The pterostigma (branch r_1) is fused with the radial ramus over a long stretch .. *Lepidopsocus*, Enderl. 1903.

(Type: L. nepticulides, Enderl. 1903).

Echmepteryx, Aaron., 1886.

Frank Aaron. Proc. Acad. Nat. Sci. Philadelphia, 1886, p. 17, figs. 4-9.

[Type E. Hageni (Packard 1870).]

Pterostigma connected with the radial ramus by a cross vein. Radial fork sometimes very small (*E. mihira*, n. sp.). Stem of the radius connected with the media by a fine and delicate cross vein which shuts in a longish pentagonal cell; this is wanting in Aaron's figure, but is presumably present also here. Radius well developed in its entire extent. In the hind wing r_1 arises before or close before the point of ramification of *cu*. Both wings more or less acuminate. Three ocelli.

TABLE OF THE SPECIES.

1. Wing short and broad. Head pale yellow with brown marking. Legs brownish yellow, tibiæ with two dark rings .. *Hageni* (Pack. 1870).
   Wing narrow and long, strongly acuminate. Head uniformly brownish yellow or brown-yellow .. 2.
2. Fore wing produced into a very fine apex. Peduncle of the radial fork more than twice as long as r_{2+3}. Scaling pale brownish yellow to gray with golden marking. Legs pale brownish yellow; apex of the femora, two rings on the tibiæ and the tarsi gray-brown .. *mihira*, n. sp.
   Fore wing acute but not produced into a long apex. Peduncle of the radial fork little longer than r_{2+3}. Scaling yellowish gray-brown, with strong yellowish silken lustre. Legs clear brownish yellow.. .. .. *sericea*, n. sp.

Echmepteryx Hageni (Packard, 1870).

Amphientomum Hagenii, Packard. Proc. Boston. Soc., vol. XIII., 1870, pp. 405–407, figs. *a—d.*

A. Hageni, Pack. Enderlein. Mitth. Zool. Mus. Berlin II. Heft II., 1902, p. 15.

Echmepteryx agilis, Aaron. Proc. Acad. Nat. Sic. Philadelphia, 1886, p. 17, figs. 4–9.

Echmepteryx Hageni (Pack.), m.

Packard *l.c.* :—

"The body generally is of a pale yellowish horn colour. Head of the same colour with a few scattered hairs. Eyes full, round, prominent, sub-globose. Ocelli arranged in a very low flat triangle; the anterior one being on a line with the front edge of the eyes. Behind each of the two basal ocelli is a blackish brown line, so doubled as to form three sides of an oblong square, with the open side facing the anterior ocellus, the inner sides meeting midway between the ocelli. A dark brown narrow line extends from eye to eye, passing upwards in the middle, between the anterior and the other two ocelli. A dark broad line extends from the eyes to the clypeus. The anterior ocellus is surrounded with black, and there is a pair of divergent dark brown lines, a little curved, sending a

branch up to the anterior ocellus. Two curved dark brown broad short bands just above the clypeus. The clypeus is free, raised above the surface of the front, and is pale horn colour (testaceous) and unspotted. Labrum black. Mandibles pale, pitchy. Antennæ with the basal joint globular; the second a little longer, oval, both very much larger than the sixteen succeeding pale horn-coloured joints, the latter being slender, gradually increasing in length to the tip, each joint provided with four or five long stiff hairs, giving a verticillate appearance to the antennæ.

"Seen in front the difference between the eyes is equal to the distance from the vertex to the base of the clypeus, the front being equilaterally triangular. Legs testaceous, the femora pale at base; beyond a little dusky, the tibiæ twice broadly ringed with dusky tarsi pale.

"Prothorax very short, the tergum being transversely linear; mesoscutum cordate. Abdomen pale, almost whitish. Upper wings regularly oval lanceolate, the tips being acute, but not prolonged; densely covered with hairs and scales, with the fringe long on the outer half of the wings, and increasing in length towards the tip so that the outline of the fringe is oval. Under the microscope the wing membrane is covered with numerous dots, arranged in irregular wavy rows, the dots much thicker along the edges than elsewhere. In the middle and along the costa the hairs are developed into regular flat scales, like those of the Lepidoptera, and the Lepismatidæ and Poduridæ, varying greatly in form, some being long and narrow, with acute teeth on the outer edge, and a rather long point of attachment; others broad and short, with blunt teeth, and others more regular in outline; all with shaded lines proceeding from each tooth and fading out towards the base of the scale.

"The wings are glistening gray, and spotted irregularly with dark towards the tips. Venation: in the fore wings a minute, almost obsolete costal vein, four subcostal venules; the main vein at the origin of the second branch anastomoses with the median vein, forming a long, narrow discal cell; at one-third the distance between the anastomosis and the tip of the wing it sends off a third branch nearly equalling in length the two basal ones; the median vein has five branches; after sending off a branch to anastomose with the subcostal vein it subdivides, the upper branch again sub-dividing midway between the tip and the anastomosis. On the basal fifth of the vein a branch arises, which subdivides, forming the fourth and fifth median venules. A straight submedian vein is present.

"Hind wings similar in form to the fore pair, but a little narrower; a slightly marked subcostal vein, ending opposite the origin of the

first and upper branch of the median vein. The median vein subdivides into five branches, the three basal, lower ones arising at nearly equal distances apart, and of nearly the same length; the first and upper one arising on the outer fourth of the wing; a slightly marked sub-median vein. The wings are folded at a low angle over the back.

"Length of body, ·10; of body with the wings folded, ·14 inch.

"I first observed this insect under the loose bark of a stump, moving in groups of several, running swiftly when disturbed, like other Psoci, to a place of concealment, at Brunswick, Maine, early in July. I also found a specimen September 1st in Salem, Mass.

"Dr. Hagen, the founder of this genus, kindly drew my attention to the great interest attaching to the discovery of this insect in this country, indicating the genus, and that the species was undescribed."

Frank Aaron. *l.c.* :—

"Antennæ much shorter than the wings, pale fuscous; palpi fuscous. Nasus = clypeus fuscous, pilose; rest of head somewhat pilose, pale, with dark brown markings, a bent brown line across the head transversely, separating the anterior from the posterior ocelli; before the ocelli, in the middle, some irregular brown markings and bands (varying in different specimens), and between the ocelli, connecting with the transverse line, two convergent brown lines, extending to a brown patch on each side upon the occiput; on each side, within the margin of the eyes, another brown spot, becoming a line, and also joining the occipital patches. Ocelli black, each one within a small brown spot; eyes brown and golden yellow. Thorax brown, portions pale luteous, dorsum of mesothorax dark brown, somewhat scaled, and very pilose. Abdomen pale yellowish or luteous (in some specimens fuscous, probably discoloured by drying), with some brown markings. Legs fuscous, somewhat paler or luteous; tarsi luteous, fuscous towards base.

"Wings fuscescent or smoky when denuded, becoming hyaline towards the apex; veins darker, semi-transparent. Scales mostly fuscesent, paler towards the base; when upon the wing seemingly fuscous, and when thickly placed appearing almost black; other scales luteous upon the wing. These scales cause the wing to be covered with black, fuscous, and luteous patches. The long apical hair mostly fuscous, luteous in patches.

"Hind wings hyaline, slightly infuscated, no scales, the long apical hair fuscous. Length to end of wing about 3 millim.

"Pennsylvania. I found this species on the trunks of beech trees in a wood near Philadelphia. It is very active, quick and difficult to secure. I believe it represents a group entirely new to our fauna."

The *Amphientomum Hageni*, Packard, proved to be a true *Echmepteryx* from the figure of the fore wing and from the description. I had already pointed out in 1902 (*l.c.* p. 15) that it did not belong to the genus Amphientomum. A comparison of this description with that of *E. agilis*, Aaron, showed that both descriptions characterise extraordinarily similar forms; only Packard's figure of the scales did not agree with Aaron's. The former however are of such a high development (at the end with 5–6 acute teeth) as has not yet been demonstrated in any of the Copeognatha (even in the differentiated forms only bidentate scales occur) more especially in such a lowly organised genus, in which and in whose allies dentate scales never occur, mostly indeed only asymmetrical scales, that I consider it very probable that Packard, who has investigated every possible order of insects, accidentally admitted some Lepidopterous scales into the preparation which naturally did not surprise him among the slender scales of Echmepteryx (*cf.* fig. 107); moreover the Lepidopterous scales may have attached themselves to the Echmepteryx in the killing bottle. I have myself often received Psocidæ which were quite covered with adhering Lepidopterous scales.

In addition there is the fact that both Packard and Aaron captured the objects in the north-western part of the United States and that in both cases they were found living on tree trunks.

I believe therefore that I am right in uniting the two species, especially because Aaron was unaware of Packard's description. In Aaron's drawing, the distal portion of the subcosta which closes the pterostigma in the fore wing, and r_1 in the hind wing, are wanting; doubtless Aaron overlooked both.

As I was about to send off this manuscript, I received, through the kindness of Mr. Banks, some examples from the United States (Falls Church, Virginia, June) alleged to be *Amphientomum Hageni*, Pack. An examination of this material completely confirmed the view which I have explained above. The scales are exactly like those figured by Aaron.

Echmepteryx mihira,* n. sp. (Figs. 22, 81, 106, 122).

Head clear brownish yellow. Hair of forehead and vertex rather long, shaggy, brownish yellow. Antennæ thin and long, about equal to length of fore wing; antennary joints short, numerous; in one antenna there are 39 joints of flagellum (consequently 41 antennary joints) present, but it is imperfect; each joint with some

* Sanskrit, = Sun.

moderately long hairs. Eyes brown-yellow, finely and rather shortly pubescent. Maxillary palp pale, end joint a little darker.

Thorax pale brownish yellow or darker, mesonotum with golden scaling. Legs very pale brownish yellow, apex of the femora, two rings on the tibiæ (one near the base, the other broader before the end) and the tarsi gray-brown. The length of the middle tibia is 0·49 mm.; of the hind tibia 0·9 mm. (fig. 122). The lengths of the tarsal joints in the middle foot are 0·19, 0·04, 0·05 mm.; in the hind foot 0·3, 0·05, 0·06 mm. The ratio of the hind tarsal joints as $6 : 1 : 1\frac{1}{5}$. First hind tarsal joint with about 13 ctenidiobothria. Claws (fig. 81) slender, with acute thin tooth before the apex and with long hair-like empodial appendix which possesses a broad lamelliform base; between this and the tooth some minute obscure knob-like denticles.

Wings very narrow and acuminate; membrane hyaline; pterostigma (fig. 106) rather broad. Radial fork very short; m_1 and m_2 very short; m_1 ending below the apex. Scaling very pale brownish yellow to gray, some relatively broad and irregular golden bands and markings (fig. 22). Marginal hair very long, pale brownish yellow and golden mixed. Hind wing very narrow; veins very pale; marginal hair very long, standing off, that of the anterior margin pale brownish, that of the hinder margin yellowish. Membrane intensely iridescent red to violet, only here and there to green.

Scales asymmetrical elongate knife-shaped (like those of *E. sericea*, n. sp.; fig. 107), at the end strongly acuminate, single ones very narrowly symmetrical.

Length of fore wing 2 mm.; wing expanse $4\frac{1}{2}$ mm.

Ceylon. Peradeniya. January, 1905; inside a folded leaf on a tree, one specimen; on a tree trunk, one specimen; collected by Mr. E. E. Green.

Echmepteryx sericea, n. sp. (Figs. 23, 80, 104, 105, 107).

Head brown-yellow. Forehead and vertex with yellow-brown, moderately long, shaggy hair. Antennæ thin, nearly equal to length of fore wing, brownish; in an incomplete antenna I counted 31 joints; antennary joints of the flagellum short, with some fairly long hairs. Eyes black-brown, with rather long and stout pubescence. Maxillary palp pale.

Thorax brown; mesonotum covered with glistening gray-brown scales. Legs clear brownish yellow, with strong yellowish silken lustre. The length of the anterior tibia is 0·39 mm.; of the middle tibia 0·49 mm.; of the hind tibia 0·84 mm. The lengths of the

tarsal joints in the middle foot are 0·19, 0·04, 0·05 mm. ; in the hind foot 0·29, 0·05, 0·06 mm. The ratio of the hind tarsal joints is as 5 : $\frac{5}{6}$: 1. First hind tarsal joints with about 14 ctenidiobothria. Claws (fig. 80) with stout tooth before the apex and setiform empodial appendix.

Wings strongly acuminate. Membrane hyaline. Pterostigma (fig. 105) moderately broad. Peduncle of the radial fork somewhat shorter than the fork ; m_1 ends below the wing apex. Scaling yellowish gray-brown with strong silken yellowish lustre. Marginal hair long and compact, of same colour.

Hind wing pale, with very long hair on the hinder margin ; veins pale brown ; membrane iridescent red to violet.

Scales (fig. 107) elongate, asymmetrical, knife-shaped, the end strongly acuminate ; some narrow symmetrical. Macrochætæ (fig. 104) almost in their entire length fairly closely beset with fine tooth like setæ.

Length of fore wing 2 mm. ; wing expanse 4½ mm.

Ceylon. Peradeniya. Under loose bark on trunk of *Artocarpus integrifolia* ; March, 1905, two specimens, collected by Mr. E. E. Green.

Lepidopsocus, Enderl., 1903.

Enderlein. Ann. Mus. Nat. Hungar. Bd. I., 1903, pp. 328–330.

Lepidopsocus nepticulides, Enderl. 1903.

Enderlein. *l.c.*, pp. 330–331, fig. 62 *a–g*. Singapore.

Sub-fam. *Echinopsocinæ*, m.

Echinopsocus, Enderl., 1903, and Scolopama, n. g., form a perfectly independent group beside the Lepidopsocinæ ; I separate them on this account as sub-family Echinopsocinæ. In my opinion numerous forms belonging to this sub-family are still to be found in the Tropics ; but in consequence of their great inconspicuousness only two species have hitherto been collected.

Fore wing with very long macrochætæ on the costal area and also on the veins and on the membrane of the marginal seam. Radial ramus simple (unforked) ; neither fused nor connected with the pterostigma. Pterostigma unusually large and very deep ; both branches quite uncommonly long. Hind wings only very minutely developed (without venation) or absent. Antennæ multiarticulate (well over 30-jointed) ; the individual antennary joints of the flagellum are very short (antennæ moniliform) little longer than thick. The wing scales are predominantly asymmetrical

(fig. 109 ♂), only isolated scales symmetrical, spatuliform (fig. 109 α-γ). Claws with a generally stout tooth before the apex and before this frequently one or several indistinct tuberculiform or acute and fine denticles. Three ocelli present or absent. Eyes pubescent.

TABLE OF GENERA OF ECHINOPSOCINÆ.

Media triramous. Hind wings only developed as minute rudiments. Fore wings rather strongly acuminate. Three ocelli present .. .. *Scolopama*, n. g.

Type: S. halterata, n. sp.

Media biramous. Hind wings absent. Fore wings produced into a long and very thin apex. Ocelli absent .. *Echinopsocus*, Enderl. 1903.

Type: E. *erinaceus*, Enderl. 1903.

Scolopama, n. g. (Figs. 108, 109, 126).

(Type : S. halterata, n. sp.)

Media triramous. Fore wings rather strongly acuminate ; with very long macrochætæ on the costal area and also on the veins and on the membrane of the marginal seam. Radial ramus simple (unforked) ; neither fused nor connected with the pterostigma. Pterostigma unusually large and very deep ; both branches uncommonly long. Hind wings only very slightly developed, without veins ; hinder margin with some very fine hairs. Eyes pubescent. Three ocelli present, placed rather close together. Antennæ with very short joints of the flagellum, which are only a little longer than thick ; presumably multiarticulate (more than 30 joints). The wing scales are chiefly asymmetrical (fig. 109 ♂) long, knife-shaped, strongly acuminate at the apex ; only certain scales are symmetrically spatuliform (fig. 109 α-β) or fusiform (γ). Claws with 3 acute and very fine denticles before the tooth which occurs before the apex, and one hair before the long setiform empodial appendix.

Scolopama halterata, n. sp. (Figs. 108, 109, 126).

Clear brownish yellow, hair of forehead and vertex long. Eyes pubescent. Ocelli fairly close together forming a rather flat triangle. Antennary joints of the flagellum very short, antennæ presumably

multiarticulate. The length of the anterior tibia is 0·47 mm.; of the middle tibia 0·57 mm.; of the posterior tibia 0·88 mm. The lengths of the tarsal joints in the fore foot are 0·17, 0·05, 0·05 mm.; in the middle foot 0·2, 0·05, 0·06 mm.; in the hind foot 0·33, 0·08, 0·09 mm. The ratio of the hind tarsal joints as $4\frac{1}{3} : 1 : 1\frac{1}{3}$. The first hind tarsal joint with about 14 ctenidia. Claws (fig. 126) slender, with thin curved apex, and a stout acute tooth rather far before it, a hair-like empodial appendix and between this and the tooth 3 small thorn-like elevations and one fine hair beside the empodial appendix.

Fore wing faintly brownish. Scaling very pale brownish gray. Hind wings very rudimentary, without veins (fig. 108), with only some fine hairs at the hinder margin.

Scales of fore wing chiefly asymmetrical, knife-shaped and elongate, end strongly acuminate (fig. 109 δ); only a few scales have the symmetrical spatuliform appearance shown in fig. 109 α-β. Some scales (fig. 109 γ) are small and narrowly fusiform.

Length of fore wing 1·4 mm.; wing expanse $3\frac{1}{4}$ mm.

Ceylon. Peradeniya; under dry foliage on the ground; March, 1905, one specimen, collected by Mr. E. E. Green.

Echinopsocus, Enderl., 1903.

Ann. Mus. Nat. Hungar. Bd. I. 1903, p. 331.

Echinopsocus erinaceus, Enderl., 1903.

Enderlein, *l.c.*, p. 332, figs. 63 *a–g*.

German New Guinea.

Family Lepidillidæ (Ribaga, 1905).

Lepidillinæ, Ribaga. Redia, vol. II. (1904) 1905, p. 100.

Head long with shaggy hair. Occipital edge sharp. Inner maxillary lobe with 3 terminal points. End joint of the maxillary palp axe-shaped. Organ of maxillary palp in the form of a short sense club. Eyes hairy in front and also in the middle. Ocelli absent. Antennæ more than 50-jointed. Prothorax large and broad, visible from above. Ends of the femora and bases of the tibiæ scaled. Claws with one tooth before the apex. Tarsi 3-jointed. Lateral valves of the telson with thorn-like appendices anales. Middle tibia with a number of very long stout setæ on the outer side. Fore wings reduced, developed as short elliptical squamæ, as in the Atropidæ. Hind wings absent. Long narrow scales occur upon

the wing squamæ, on the ends of the femora, the base of the tibiæ ; shorter and broader fusiform scales at various places on the upper side of the abdomen.

In the types of *Lepidilla* the long setæ of the hind tibiæ and the squamiform fore wings have been broken off.

Ribaga places this group as a sub-family of the Atropidæ. These however never have toothed claws and are never scaled, so that one might better place them among the Lepidopsocidæ. But even here they seem to me to have no right place. The complete lack of venation in the peculiar squamiform wings separates them from these and appears, in this respect, to approximate them to the Atropidæ. If therefore the Lepidopsocidæ and Atropidæ be not united in one family, which in my opinion is absolutely inadmissible, one is compelled to regard the Lepidillidæ as a distinct family. Until further species settle this question definitely I regard this group in the meantime as Lepidillidæ.

TABLE OF GENERA OF LEPIDILLIDÆ.

Prothorax very short, much shorter than the mesothorax. Second and third joints of maxillary palp without external end spur. .. *Lepidilla*, Rib. 1905.

(Type : L. Kelloggi, Rib. 1905.)

Prothorax very long, longer than the mesothorax. Second and third joints of the maxillary palp with stout and long end spur .. *Lepolepis*, n. g.

(Type : L. ceylonica, n. sp.).

Lepolepis, n. g.

Inner maxilla trifid ; end joint of maxillary palp axe-shaped, second and third joints with stout and long end spur. Antennæ more than 50-jointed, the joints are 1-2 times as long as thick. Ocelli absent. Eyes large, pubescent in front and in the middle. Sagittal and frontal sutures distinct. Prothorax large and long, larger than the mesothorax. Fore wings squamiform. Hind wings not developed. Meso and metathorax and middle segment close together, the last very large. Abdomen 10-jointed including the telson. The latter trilobate, the lateral lobes each with a setiform appendix analis. Tibiæ with 2 end spurs ; those of the two posterior pairs of legs with numerous setæ which are very stout on the middle

legs. Claws slender, with sharp tooth before the apex, before this in the hind foot traces of microscopic denticles. Empodial appendix in the form of a straight seta.

The following parts carry scales :—The anterior side of the ends of the femora, the outer side of the bases of the tibiæ, the mesothorax, the fore wing squamæ rather closely, further on the upper side of the abdomen, the sides of segments 3-7 and the 8th and 9th segments. Scales more or less slender or compressed fusiform.

Lepolepis Ceylonica, n. sp. (Figs. 24, 114–116, 118–120).

Ochreous yellow, the femora, tibiæ, and first tarsal joints somewhat darker. Eyes black, the ommatidia standing out glossy yellow. Wing squamæ clear brown, 9th segment and telson brown. Head shaggily hairy, especially in front and at the sides. Appendices anales very stout, very faintly curved inwards. Scaling brown The scales of the wing rudiments long and narrow, those of the abdomen short and compressed. Scaling of upper side of abdomen compact. Ratio of hind tarsal joints as $5\frac{1}{4} : 1 : 1$. Ctenidiobothria absent from the first hind tarsal joint.

Length of body 3–$3\frac{1}{4}$ mm. ; abdomen $1\frac{3}{4}$ mm. ; head length $\frac{3}{4}$ mm. ; antennæ about $2\frac{1}{2}$ mm.

Ceylon. Peradeniya. Two females, on walls and ceilings inside houses ; collected and preserved in alcohol by Mr. E. E. Green.

Lepidilla, Ribaga, 1905.

Ribaga. Redia, vol. II. (1904), 1905, p. 99, Taf. 9.

Inner maxilla three-tipped. End joint of maxillary palp axe-shaped ; second and third joints with external end spurs. Antennæ multiarticulate (?), the antennary joints are more than three times longer than thick. Ocelli absent. Eyes large, finely hairy in front. Sagittal suture and frontal suture distinct. Prothorax feebly developed, not pushed below the mesothorax, but very short. Fore wings presumably squamiform, but broken off. Hind wings not developed ; mesothorax, metathorax, and first abdominal segment (median segment ?) closely conjoined as in all Atropidæ ; the last named segment is as broad as the metathorax. Abdomen 10-jointed, including the telson. Telson trilobate, the side lobes each with a setiform appendix analis. Tibiæ with two end spurs, those of the two hinder pairs of legs with numerous setæ. Claws slender with sharp tooth before the apex and before the tooth numerous microscopic hairlets. Empodial appendix in the form of a curved seta.

The following parts are scaled :—The anterior side of the femoral ends, the outer side of the tibial bases, the mesothorax ; some scales occur also on the upper side of the 9th abdominal segment. The scales are fusiform, those of the 9th segment especially truncate-acuminate at the end.

Lepidilla Kelloggi, Ribaga, 1905 (Figs 113, 124).

Ribaga, *l.c.*, p. 100. Taf. 9. figs. 1–9, Taf. 10, figs. 10–11.

Ochreous yellow ; brownish markings with violet tint occur as follows :—A reticulate pattern on the clypeus, the marking of the forehead and vertex as shown in the illustration, the end joint and the outer side of the second and third joints of the maxillary palp, the apices of the two basal joints of the antennæ, the marking of the thorax as shown in the illustration, a small spot posteriorly before the end of the femora, two rather broad rings round the tibiæ, dividing the latter into three equal parts, the basal part of the first tarsal joint ; a longitudinal streak on each side of the 9th segment and the lateral valves of the telson. Appendices anales stout, somewhat curved inwards. Ratio of the hind tarsal joints as $5 : 1 : \frac{7}{8}$.

Length of body 3 mm. ; of abdomen 1·3 mm.

California. Stanford. Three females.

The above description of genus and species is based upon a type specimen which Dr. C. Ribaga had very kindly placed at my disposal for this purpose.

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(Synonyma are *cursiv.*)

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* See page 77, footnote.

EXPLANATION OF THE PLATES.

(For Vol. III. on plates A–G, read Vol. IV.)

Plate A.

Fig. 1. *Tineomorpha Greeniana*, Enderl., n. g. n. sp.
Right fore wing and hind wing, × 12.

Fig. 2. *Syllysis Erato*, Enderl., n. sp., ♀.
Right fore wing and hind wing, × 27.

Fig. 3. *Syllysis ritusamhara*, Enderl., n. sp., ♀.
Right fore wing and hind wing, × 27.

Fig. 4. *Seopsis metallops*, Enderl., n. sp.
Right fore wing and hind wing, × 27.

Fig. 5. *Seopsis Vasantasena*, Enderl., n. sp.
Right fore wing and hind wing, × 27.

Fig. 6. *Seopsis superba* (Hag.).
Right fore wing and hind wing, × 27.

Fig. 7. *Paramphientomum Nietneri*, Enderl., n. g. n. sp.
Right fore wing and hind wing, × 27.

Plate B.

Fig. 8. *Soa flaviterminata*, Enderl, n. sp.
Right fore wing and hind wing, × 27.

Fig. 9. *Perientomum chrysargyrium*, Enderl., n. sp
Right fore wing and hind wing, × 27.

Fig. 10. *Perientomum Greeni*, Enderl., n. sp.
Right fore wing and hind wing, × 27.

Fig. 11. *Perientomum morosum*, Hag. ♀.
Right fore wing and hind wing, × 27.

Fig. 12. *Perientomum triste*, Hag.
Right fore wing and hind wing, × 27.

Fig. 13. *Perientomum ceylonicum*, Enderl., n. sp.
Right fore wing and hind wing, × 27.

Fig. 14. *Perientomum argentatum*, Enderl., n. sp.
Right fore wing and hind wing, × 27.

Fig. 15. *Lepium chrysochlorum*, Enderl., n. sp.
Right fore wing and hind wing, × 27.

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Fig. 16. *Lepium luridum*, Enderl., n. sp.
Right fore wing and hind wing, × 27.

Fig. 17. *Nepticulomima Essigkeana*, Enderl., n. g. n. sp.
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Fig. 22. *Echmepteryx mihira*, Enderl., n. sp.
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Fig. 23. *Echmepteryx sericea*, Enderl., n. sp.
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The left wing squame as well as the legs and antenna of the left side are supposed to be removed, × 27.

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Right hind leg seen in front view, × 60.

a–h. Spurs of the first tarsal joint.

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Fig. 129. The same. Scales of fore wing, × 350.

a. Principal form. b. Form from the vicinity of the outer margin. *rs.* Marginal scales.

Fig. 130. The same. Right maxillary palp from above, × 110. *sk.* Sense club. *sp.* Spurs.

Plate D.

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Venation of the right fore wing and hind wing, × 12.

Fig. 26. The same. var. *major*, Enderl., n.
Venation of the right fore wing and hind wing, × 12.

Fig. 27. *Paramphientomum Nietneri*, n. g. n. sp.
Venation of right fore wing and hind wing, × 18.

Fig. 28. The same. Scales of fore wing, × 400. *rs.* Marginal scale.

Fig. 29. The same. Scales from hind wing, × 400. *rs.* Marginal scale.

Fig. 30. *Seopsis Vasantasena*, Enderl., n. sp.
Venation of right fore wing and hind wing, × 27.

Fig. 31. The same. Wing scales, × 400.
α and *β*. Fore wing scales. *γ–ζ*. Hind wing scales.

Fig. 32. *Seopsis Vasantasena*, Enderl., n. sp.
Venation of right fore wing and hind wing, × 27.

Fig. 33. *Seopsis metallops*, Enderl., n. sp. Wing scales, × 400.
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Fig. 34. *Paramphientomum Nietneri*, Enderl. n. g. n. sp.
Ocelli, × 160.

Fig. 35. *Seopsis Vasantasena*, Enderl., n. sp.
Ocelli, × 160.

Fig. 36. *Seopsis superba* (Hag.). Wing scales, × 400.
α β. Fore wing scales. *γ–ε*. Hind wing scales. *β. δ* and *ε*. Marginal scales.

Fig. 37. *Syllysis Erato*, Enderl., n. sp. ♂.
Venation of right fore wing and hind wing, × 18.

Fig. 38. The same. ♀. Venation of right fore wing and hind wing, × 18.

Fig. 39. *Syllysis ritusamhara*, Enderl. ♂.
Venation of right fore wing and hind wing, × 18.

Fig. 40. The same. ♀. Venation of right fore wing and hind wing, × 18.

Fig. 41. *Soa flaviterminata*, Enderl., n. sp.
Venation of right fore wing and hind wing, × 27.

Fig. 42. *Syllysis Erato*, Enderl., n. sp.
Fore wing scales, × 400. *rs.* Marginal scales.

Fig. 43. The same. Hind wing scales, × 400. *rs.* Marginal scales.

Fig. 44. *Soa flaviterminata*, Enderl., n. sp.
Fore wing scales, × 400. *rs.* Marginal scale.

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Fig. 46. The same. Fore wing scales, × 400.
gs. Ground scales. *ds.* Cover scale. *rs.* Marginal scale.

Fig. 47. *Perientomum morosum*, Hag.
Venation of fore wing and hind wing, × 27.

Fig. 48. *Perientomum chrysargyrium*, Enderl., n. sp.
Fore wing scales, × 400. *gs.* Ground scales.
ds. Cover scale. *vrs.* Anterior marginal scale.

Fig. 49. *Perientomum morosum*, Hag. Fore wing scales, × 400.
gs. Ground scales. *ds.* Cover scales.

Fig. 50. *Perientomum argentatum*, Enderl., n. sp.
Fore wing scales, × 400. *gs.* Ground scales. *ds.* Cover scale.
mch. Macrochæta.

Fig. 51. *Perientomum Greeni*, Enderl., n. sp.
Fore wing scales, × 400. *mch.* Macrochæta. *rs.* Scale from the base of the anterior margin.

Fig. 52. The same. Venation of fore wing and hind wing, × 27.

Fig. 53. The same. Fore wing scales, × 400. *ds.* Cover scale. *gs.* Ground scales.

Fig. 54. *Syllysis ritusamhara*, Enderl., n. sp.
Claw from the hind foot, × 700.

Fig. 55. *Syllysis Erato*, Enderl., n. sp.
Claw from the hind foot, × 700.

Fig. 56. *Paramphientomum Nietneri*, Enderl., n. g. n. sp.
Claw from the hind foot, × 700.

Fig. 57. *Seopsis metallops*, Enderl., n. sp.
Claw from the hind foot, × 700.

Fig. 58. *Seopsis Vasantasena*, Enderl., n. sp.
Claw from the hind foot, × 700.

Fig. 59. *Soa flaviterminata*, Enderl., n. sp.
Claw from the hind foot, × 700.

Fig. 60. *Perientomum chrysochlorum*, Enderl., n. sp.
Venation of right fore wing and hind wing, × 27.

Fig. 61. The same. Fore wing scales, × 400.
gs. Ground scales. *ds.* Cover scale. *rs.* Marginal scale.

Fig. 62. *Perientomum triste*, Hag.
Venation of right fore wing and hind wing, × 27.

Fig. 63. The same. Fore wing scales, × 400.
gs. Ground scales. *ds*. Cover scales. *gs'*. and *ds'*. predominant.

Fig. 64. *Lepium luridum*, Enderl., n. sp.
Venation of right fore wing and hind wing, × 27.

Fig. 65. The same. Fore wing scales, × 400.
gs. Ground scale. *ds*. Cover scale. *rs*. Posterior marginal scales.

Fig. 66. *Perientomum acutipenne*, Enderl., n. sp.
Venation of right fore wing and hind wing, × 27.

Fig. 67. The same. Fore wing scales, × 400.
gs. Ground scale. *ds*. Cover scale. *rs*. Posterior marginal scale.

Fig. 68. *Tineomorpha Greeniana*, Enderl., n. g. n. sp.
Claw from the hind foot, × 700.

Fig. 69. *Perientomum morosum*, Hag.
Claw from the hind foot, × 700.

Fig. 70. *Perientomum triste*, Hag.
Claw from the hind foot, × 700.

Fig. 71. *Perientomum Greeni*, Enderl., n. sp.
Claw from the hind foot, × 700.

Fig. 72. *Perientomum acutipenne*, Enderl., n. sp.
Claw from the hind foot, × 700.

Fig. 73. *Lepium luridum*, Enderl., n. sp.
Claw from the hind foot, × 700.

Fig. 74. *Perientomum chrysargyrium*, Enderl., n. sp.
Claw from the hind foot, × 700.

Fig. 75. *Perientomum argentatum*, Enderl., n. sp.
Claw from the hind foot, × 700.

Fig. 76. *Nepticulomima chalcomelas* Enderl. n. g. n. sp.
Claw from the hind foot, × 700.

Fig. 77. *Nepticulomima Sakuntala*, Enderl., n. g. n. sp.
Claw from the hind foot, × 700.

Fig. 78. *Nepticulomima brasiliensis*, Enderl., 1906.
Claw from the hind foot, × 700.

Fig. 79. *Nepticulomima Essigkeana*, Enderl., n. sp.
Claw from the hind foot, × 700.

Fig. 80. *Echmepteryx sericea*, Enderl., n. sp.
Claw from the hind foot, × 700.

Fig. 81. *Echmepteryx mihira*, Enderl., n. sp.
Claw from the hind foot, × 700.

PLATE F.

Fig. 82. *Nepticulomima Sakuntala*, Enderl., n. g. n. sp.
Venation of right fore wing and hind wing, × 27.

Fig. 83. The same. Fore wing scales, × 400. *gs*. Ground scale.
ds. Cover scale. *vrs*. Anterior marginal scale.

Fig. 84. *Nepticulomima Essigkeana*, Enderl., n. g. n. sp.
Venation of right fore wing and hind wing, × 27.

Fig. 85. The same. Fore wing scales, × 400.
ds. Cover scales. *gs*. Ground scales.

Fig. 86. *Nepticulomima brasiliensis*, Enderl., 1906 (Brazil).
Venation of right fore wing and hind wing, × 27.

Fig. 87. The same. Fore wing scales, × 400. *gs.* Ground scales. *ds.* Cover scale. *rs.* Marginal scale.

Fig. 88. *Nepticulomima chalcomelas*, Enderl., n. g. n. sp.
Venation of right fore wing and hind wing, × 27.

Fig. 89. The same. Fore wing scales, × 400.
gs. Ground scales. *ds.* Cover scale.

Fig. 90. *Nepticulomima Hösemanni*, Enderl., 1903 (Cameroon).
Venation of right fore wing and hind wing, × 27.

Fig. 91. The same. Fore wing scales, × 400. *gs.* Ground scales. *ds.* Cover scale.

Fig. 92. *Seopsis metallops*, Enderl., n. sp.
Right inner maxillary lobe from above, × 120.

Fig. 93. The same. Right maxillary palp from above, × 160. *sk.* Sense club.

Fig. 94. *Tineomorpha Greeniana*, Enderl., n. g. n. sp.
Right maxillary palp in outline, × 60.

Fig. 95. *Syllysis Erato*, Enderl., n. sp.
Right maxillary palp from above, × 160.

Fig. 96. *Syllysis ritusamhara*, Enderl., n. sp.
First and second joints of the left maxillary palp from above, × 160. *sk.* Sense club (organ of maxillary palp).

Fig. 97. *Tineomorpha Greeniana*, Enderl., n. g. n. sp.
First and second joints of the right maxillary palp from above, × 160. *sh.* Sense hair (organ of maxillary palp).

Fig. 98. *Cymatopsocus opalinus*, Enderl., 1903 (Further India).
First and second joints of the left maxillary palp from above, × 160. *sh.* sense hair.

Fig. 99. *Nepticulomima chalcomelas*, Enderl., n. g. n. sp.
Right maxillary palp from above, × 160. *sk.* Sense club (organ of maxillary palp).

Fig. 100. *Tineomorpha Greeniana*, Enderl., n. g. n. sp.
Inner lobe of right maxilla from above, × 120.

Fig. 101. *Perientomum chrysargyrium*, Enderl., n. sp.
Inner lobe of right maxilla from above, × 160.

Fig. 102. *Syllysis Erato*, Enderl., n. sp.
Inner lobe of right maxilla from above, × 120.

Fig. 103. *Seopsis Vasantasena*, Enderl., n. sp.
Inner lobe of left maxilla from below, × 160.

Fig. 104. *Echmepteryx sericea*, Enderl., n. sp.
Macrochæta from the fore wing, × 700.

Fig. 105. The same. Venation of right fore wing and hind wing. × 40.

Fig. 106. *Echmepteryx mihira*, Enderl., n. sp.
Venation of right fore wing and hind wing, × 40.

Fig. 107. *Echmepteryx sericea*, Enderl., n. sp.
Fore wing scales, × 400.

Fig. 108. *Scolopama halterata*, Enderl., n.g. n.sp.
Right fore wing and hind wing, × 60.

Fig. 109. The same. Fore wing scales, × 400.
α and *β*. Particular or intercalary scales. *γ*. Intercalary scale from anterior margin. *δ*. Predominant form of asymmetrical scale.

PLATE G.

Fig. 110. *Perientomum Hösemanni*, Enderl., 1903, ♀ (Cameroon).
Abdominal apex from below, × 120. *gp*. Gonapophyses. 9. Ninth segment. *te* Telson. *aa*. Appendices anales.

Fig. 111. *Syllysis ritusamhara*, Enderl., n. sp.
Inner lobe of left maxilla from above, × 160.

Fig. 112. *Paramphientomum Nietneri*, Enderl., n.g. n.sp.
Inner lobe of right maxilla from above, × 160.

Fig. 113. *Lepidilla Kelloggi*, Rib., 1905 (North America, California).
Inner lobe of left maxilla from above, × 160.

Fig. 114. *Lepolepis ceylonica*, Enderl., n. g. n. sp.
Inner lobe of left maxilla from below, × 160.

Fig. 115. The same. Portion of right antenna, × 160.

Fig. 116. The same. Rudimentary right wing, × 60.

Fig. 117. *Nepticulomima Sakuntala*, Enderl., n.g. n.sp.
Right hind leg, × 60.

Fig. 118. *Lepolepis ceylonica*, Enderl., n.g. n.sp., × 400.
α–δ. Scales from the wing squama. *rs*. Scale from the abdomen.

Fig. 119. The same. Right maxillary palp from below, × 160.
sk. Sense club.

Fig. 120. The same. Claw of hind foot, × 400.

Fig. 121. *Seopsis metallops*, Enderl., n. sp.
Right hind tibia from behind, × 60.

Fig. 122. *Echmepteryx mihira*, Enderl., n. sp.
Right hind tibia from behind, × 60.

Fig. 123. *Seopsis superba* (Hag).
Right hind leg, × 60.

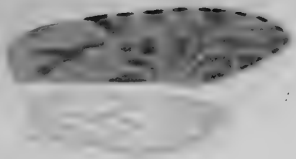
Fig. 124. *Lepidilla Kelloggi*, Rib., 1905 (North America).
Claw of hind foot, × 400.

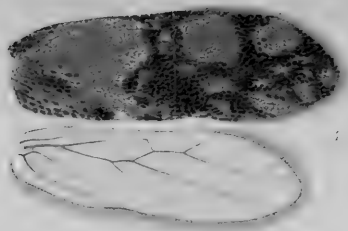
Fig. 125. *Nepticulomima Sakuntala*, Enderl., n.g. n.sp.
Right antenna from above, × 60.

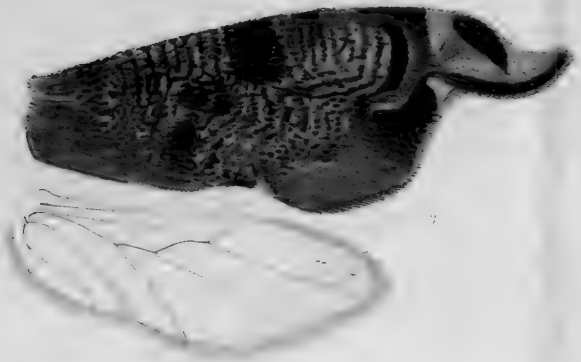
Fig. 126. *Scolopama halterata*, Enderl., n.g. n.sp.
Claw, × 700.

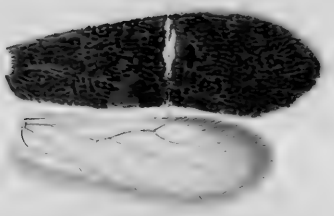
Fig. 127–130, *vide* Plate C.

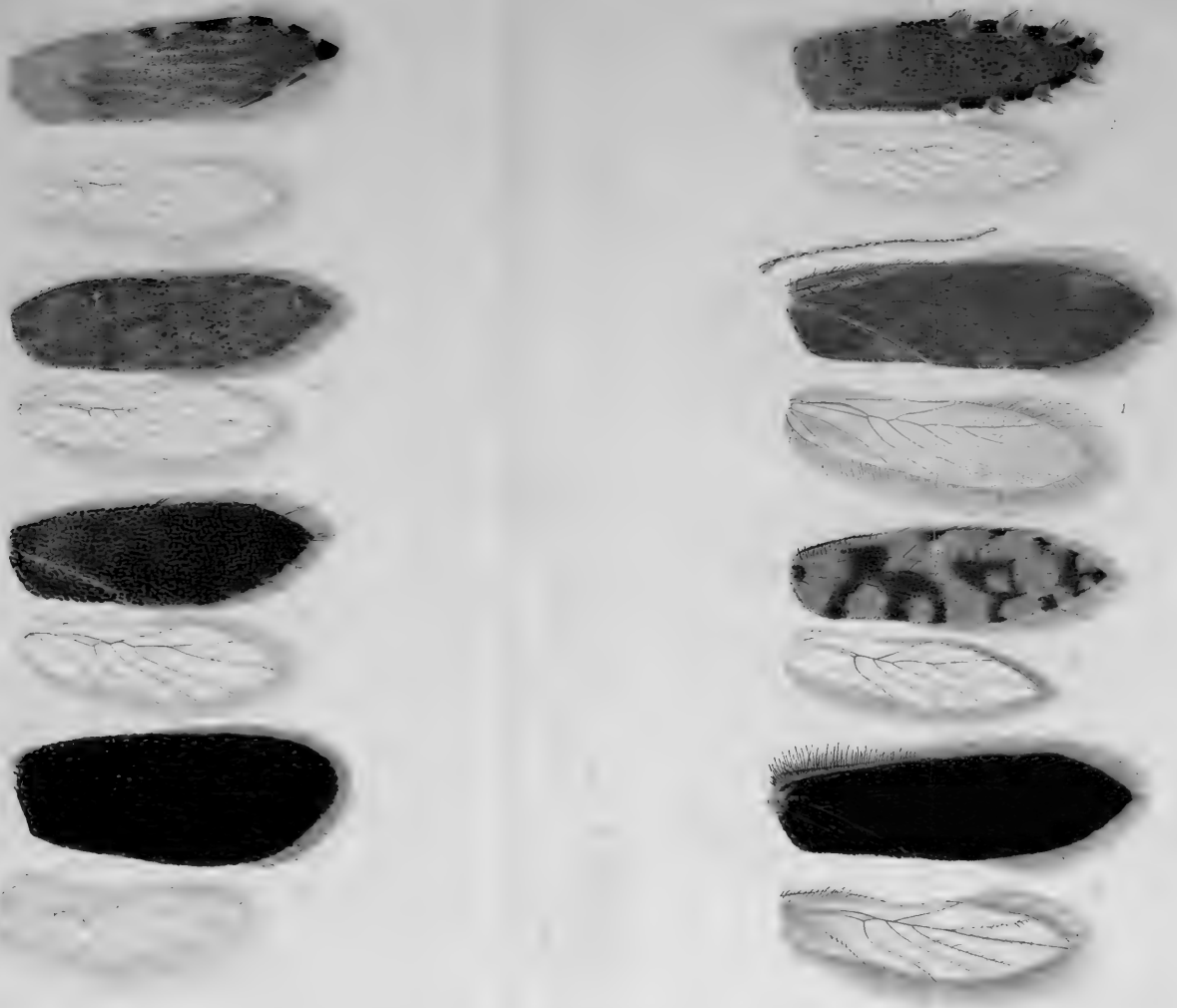
[The foregoing paper by Dr. Enderlein was written by that author in German ; was translated by Dr. Willey (while on leave in England) and submitted to Dr. Enderlein for his approval. To avoid further delay in publication, the author has foregone his personal supervision of the proofs which have accordingly been corrected by me, in Ceylon. The difficulties of this divided labour must be our excuse for any small errors that may have been overlooked.—E.E.G.]

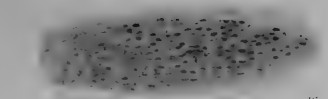








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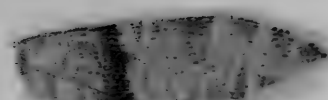
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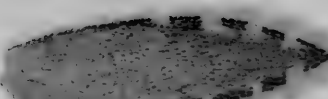
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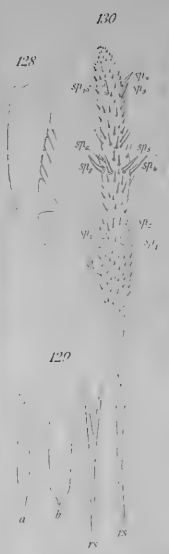
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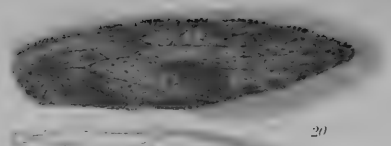
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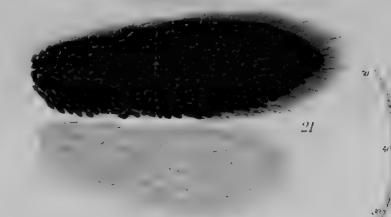
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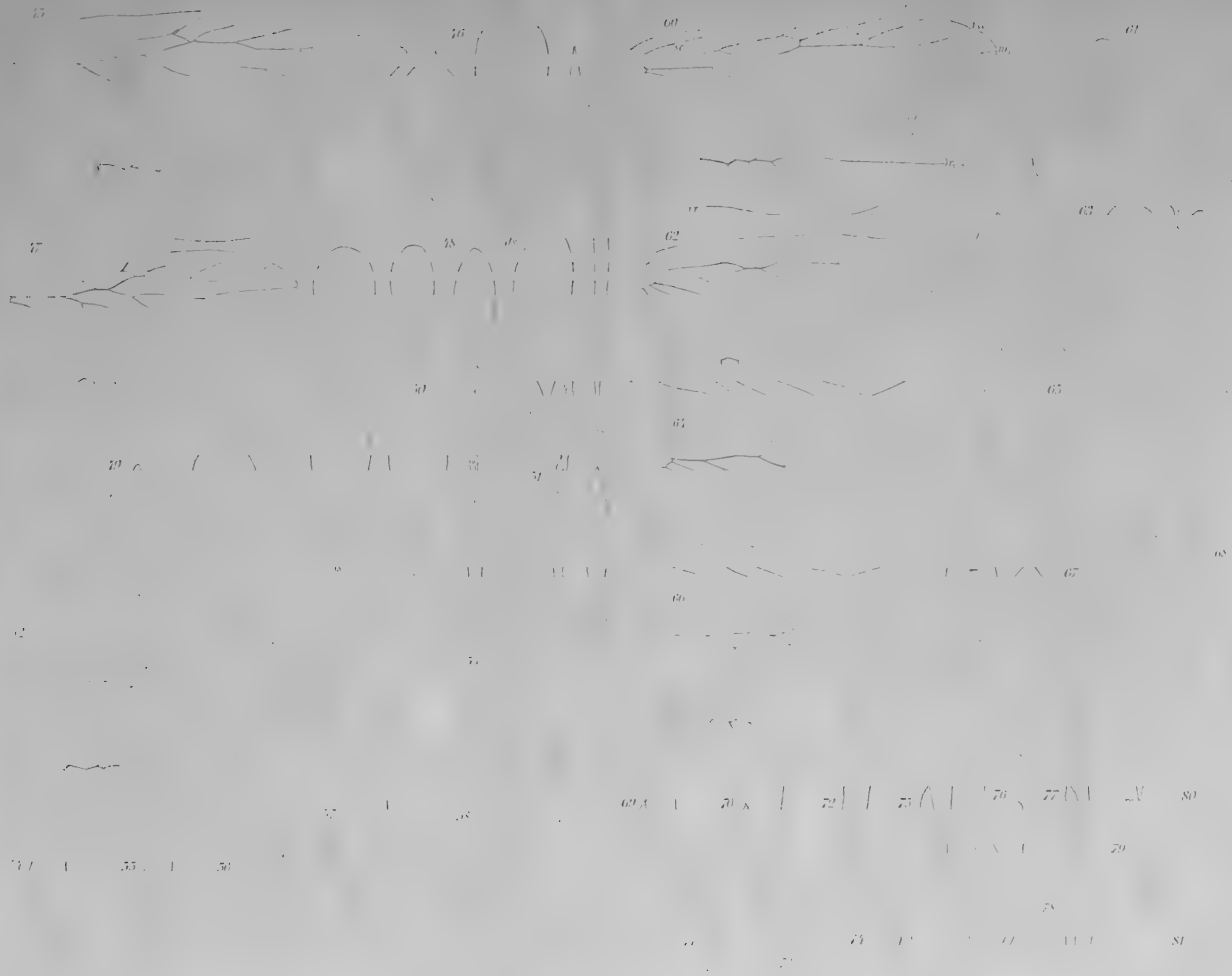
16. *Lepium luridum* Enderl. 17. *Nepticulomima Essigkeana* Enderl. 18. *N. Hösemanni* Enderl.
19. *N. brasiliensis* Enderl. 20. *N. Sakuntala* Enderl. 21. *N. chalcomelas* Enderl. 22. *Echmepteryx mihira* Enderl.
23. *Echmepteryx sericea* Enderl. 24. *Lepolepis ceylonica* Enderl. 127-130. *Stimulopalpus japonicus* Enderl.

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SUPPLEMENTARY NOTE ON THE SCALY WINGED COPEOGNATHA.

By E. Ernest Green.

IN the foregoing paper Dr. Enderlein has given us very careful and elaborate descriptions of the remarkable little scaly-winged insects allied to the Psocidæ or "book lice." A few notes on the habits and appearance of these insects in life may be of interest to the general reader and of use to those who may wish to collect and study them. In this connection it may be mentioned that of the twenty-five species collected by me in Ceylon, all but three or four were taken in the Peradeniya Gardens. It is probable therefore that a careful search in other parts of the Island—to say nothing of the Oriental region in general—will bring to light numerous other species, and perhaps still more extraordinary and beautiful forms.

In general appearance they may be likened to minute moths, their wings and bodies being usually clothed with scales greatly resembling those of the Lepidoptera. Some species have a more hairy appearance, though most of these hairs are really elongated scales. Such species might perhaps be mistaken for the hairy-winged flies—Psychodidæ.

Several species are to be found frequenting buildings. They seem to prefer damp situations, such as outside walls, especially where minute algæ have obtained a footing. But there are others that I have taken only inside houses—either on the walls and ceilings or amongst books and old papers. The greater number of (and more interesting) species are to be found upon the trunks of trees and under loose bark.

They may be recognized by their movements. When disturbed, they run rapidly for a short distance and then come to a halt. The species that frequent the trunks of trees are practically invisible so long as they remain still, their colour harmonizing with the varied tints of the lichens and algæ on the bark. They appear to prefer such trees as have a comparatively smooth bark. I have seldom found them upon gnarled or corky stemmed trees. I do not think that the species of tree *per se* has anything to do with this preference. It is more a question of the vegetable growths on the

bark, upon which growths I am inclined to believe that they feed, though I have never been able to prove this by actual observation. My most fruitful hunting ground has been the stems of various palm trees, especially those of the "Royal Palm" (*Oreodoxa regia*). Partial shade is evidently essential to their comfort. The more exposed stems were always found to be untenanted. The best way to find the insects is to pass the hand slowly up the trunk without actually touching it. This will flush any individual within range and induce it to move off in a series of short jerks, when it can be located and—with practice—safely captured in the manner described below.

Though provided with functional and quite usetul wings, the insects seldom take flight unless hard pressed. They are, nevertheless by no means easy to capture. An ordinary net is quite useless. Even if they should take flight, they are so small that the eye can scarcely follow them. I have found a small glass tube (containing a fragment of cyanide of potassium wrapped in tissue paper) the most successful instrument for their capture. It must be of not more than five-eighths inch diameter, otherwise it will not fit sufficiently close to the rough surface of a wall or the convexity of a tree trunk ; and if there is the smallest crevice the little creature will most assuredly discover it and escape through it. Having located your specimen, the mouth of the tube must be cautiously approached and then suddenly placed over the insect. On the first and probably many successive attempts the insect will dodge out of the way, but with patience it can eventually be enclosed within the mouth of the tube. Then still further patience is required. Any attempt to force the insect to leave its support and enter the tube will meet with failure and probably afford further opportunities of escape. The tube must be held firmly in place until the captive is asphyxiated by the fumes of the cyanide, when it will drop off into the glass. This may take a minute or more to effect. Species that occur under loose bark or in decayed wood may be shaken off on to a piece of white cloth and bottled from there.

Attempts to keep the insects alive in captivity for any length of time have invariably proved unsuccessful. It is difficult to adjust the humidity to their requirements.

I have found the eggs of one species only (*Paramphientomum Nietneri*). I found this species in large numbers on a cement covered parapet; and in small cavities in the cement were numerous packets of eggs concealed beneath a crust of earthy particles. On

confining a few of the insects in a glass jar together with broken tiles and pieces of cement, similar egg packets were deposited. In this case the covering material appeared to be cement dust worked up into a paste. Each little nest contained about half a dozen eggs, packed side by side. The eggs are of a pale orange-yellow colour, irregularly oval, and measuring approximately 0·50 by 0·25 mm. I was unsuccessful in my attempts to hatch out these eggs. Some of them dried up without maturing and the remainder died and became mouldy.

The nymphs may often be found in the company of the adult insects. They resemble wingless species of Psocus, and in some species are more or less clothed with scales—like the adults.

ON TWO NEW ENTOMOSTRACA FROM CEYLON.

BY

ROBERT GURNEY.

With two Plates.

A COMPREHENSIVE survey of our knowledge of the freshwater Entomostraca of Ceylon was published in 1898 by Daday, and since then nothing has been added to it so far as I am aware. Combining the species recorded for the first time in his paper with those previously described by Brady (1886) and Poppe and Mrazek (1895), he gives a list containing one Phyllopod, twelve Copepoda, and thirty-six Cladocera. Thanks to the papers of Sars, Stingelin, and Richard, we have a list of Entomostraca from the Indo-Malayan sub-region comprising two Phyllopoda, forty-six Cladocera, and six Copepoda, but practically nothing is known at present with regard to India. We are also far from having a complete knowledge of the Entomostraca of the Ethiopian and Australian regions, so that at present the facts at our disposal are too limited to allow of satisfactory deductions being made with regard to geographical distribution. The difficulty is also much increased by the fact that many genera and some species have a world-wide distribution, and appear to be independent of barriers, which hinder the disposal of other forms. Whether this is due to an extreme adaptability, or indicates a distinction between primitive widely distributed forms and those of more recent origin (Moore, 1903), it is difficult to say. However, so far as the facts go it may be useful to summarize them. Taking the Cladocera as being the most numerous and best known group, we find that of the thirty-six species and varieties recorded from Ceylon thirteen are peculiar to it, so far as is known at present. The following are the numbers of species and varieties common to Ceylon and the various Zoogeographical Regions :—

Palæarctic	10
Nearctic	4
Neotropical	8
Ethiopian	5
Australian	10
Indo-Malayan Sub-region	18

If we exclude those species which are found both in Ceylon and in more than one other region*—that is, the widely distributed species—the numbers are as follows :—

Palæarctic	1
Nearctic	—
Neotropical	—
Ethiopian	—
Australian	—
Indô-Malayan Sub-region	4

The single species found only in the Palæarctic Region and in Ceylon is *Chydorus ovalis*, Kurz. It was recorded by Poppe and Mrazek, but they expressed some doubt as to its identity with the European species. Seeing that the genus Chydorus is peculiarly rich in Oriental species, differing but little one from another, this record cannot carry much weight.

From the figures given above it is evident that the Entomostracan fauna of Ceylon contains a large proportion of peculiar forms, and that, of the remainder, those that are limited to a single region are all Indo-Malayan species. There is no doubt therefore that there is a close relationship between the fauna of Ceylon and Indo-Malaya, but it is not safe to speculate on relationships with regions lying further afield.

Through the kindness of Dr. Willey I have recently received specimens of a *Diaptomus* and a *Streptocephalus* collected in Ceylon, and it is further evidence of the richness and peculiarity of the fauna that both species prove to be undescribed. They were collected by Mr. E. E. Green in a muddy stagnant pool on the Cotton Experiment Station at Maha Ilupalama in the North-Central Province of Ceylon when looking for Mosquito larvæ.

The following is a description of these species :—

Order : PHYLLOPODA.

Streptocephalus spinifer, n.sp. (Plate I.)

The body in both sexes is somewhat slender, the head and thorax together a little longer than the abdomen without the caudal rami ; the following are the measurements of three specimens :—

	Female.		Male.
	I.	II.	
Head and thorax ..	5·25 mm. ..	4· 5 mm. ..	5. 5 mm.
Abdomen ..	5· 0 mm. ..	3·75 mm. ..	5. 0 mm.
Caudal rami ..	2· 0 mm. ..	1· 5 mm. ..	2.75 mm.
Egg sac ..	3· 7 mm. ..	2· 5 mm. ..	—
Total length ..	12·25 mm. ..	9·75 mm. ..	13·25 mm.

* For the purposes of this comparison I consider Ceylon as a region by itself, distinct from the rest of the Oriental Region.

The head of the male is produced in front, beneath the frontal process, into a distinct, downwardly-curved, spiniform rostrum (fig. 4). The segments of the thorax are simple, as are also those of the abdomen in the female. In the male, on the other hand, each segment, with the exception of the first and the last, bears one or more spines. The second segment bears only a lateral pair, but the next five bear both a pair of long dorsal spines and a lateral spine on each side diminishing in size in the posterior segment. The seventh segment bears a pair of dorsal spines and a pair of very minute lateral spines, and the eighth a single median dorsal spine. The caudal rami in both sexes are long. In the male they are only slightly curved, ciliated at their base, but provided for about the distal two-thirds of their length with strong curved spines on either side (fig. 8). In the female they are more divergent, and fringed with setæ along both edges.

Unlike the majority of the genus Streptocephalus, the male has the frontal processes enormously developed. They are fused at their base into a single cylindrical process, but are distinct for the greater part of their length. Distally they divide again into dorsal and ventral branches. The ventral branch is short and simple, but the dorsal branch bears a row of papillæ along its ventral edge. The first pair of antennæ are long, in the male about equalling in length the first joint of the second antennæ, and in the female somewhat exceeding the length of the second pair. The second pair of antennæ in the female are short, narrow, triangular plates fringed with hairs, but without any terminal projection. Those of the male are long chelate appendages. The basal segment is about equal in length to the second segment and bears a long apophysis : the terminal portion is narrow and produced into two long sub-equal processes. Each of these has a small inner lobe at its base of somewhat variable form (fig. 5). The branchial legs are of the usual form (figs. 6 and 7). The basal plate (bract) has its edge serrated. The exopodite is much longer than the endopodite, the distal margin of the latter more or less squarely truncated. The penis of the male (fig. 9) scarcely extends beyond the third abdominal segment, the reversible part not spinous. The egg-sac of the female is narrow, cylindrical, and pointed at the extremity, reaching to the middle of the sixth segment of the abdomen.

Three males and three females of this species were collected by Mr. Green, who describes its appearance in life as follows : —" Prominent black eyes ; body pale translucent, yellowish-greenish ; a pair of brilliant scarlet cerci at extremity." One or two of the specimens have what appear to be large branching chromatophores

in the posterior part of the abdomen, which perhaps are the seat of the red pigment.

The species is one of peculiar interest in more than one respect. The female is of a perfectly normal type, but the male differs strikingly from any species of Streptocephalus hitherto described. In particular it is distinguished by the enormous development of the frontal processes, which about equal the second antennæ in size. In the majority of the species of this genus the frontal processes are reduced and fused into a small plate, sometimes showing traces of its originally paired origin by the presence of a small emargination of the tip; for example, *S. rubricaudatus*, Klunz. and *S. vitreus*, Brauer. In others they are almost entirely suppressed, as in *S. purcelli*, Sars. In only one or two cases are they very conspicuous. These are *S. proboscideus*, Frauenfeld, and *S. neumanni*, Thiele. The frontal processes of the latter are of almost exactly the same type and relative size as those of *S. spinifer*. They differ in that the main fused stem gives off on either side a branch, and is itself produced into a long recurved process. It is, in fact, a trifid frontal process.

The possession by the male of spines on the abdominal segments, which has suggested the name given to the species, is a striking, but not distinctive, feature of it. In *S. neumanni* also the abdomen is armed with spines in the male but not in the female, but in this case they are ventral and unpaired. It appears to be the rule among the Branchipodidæ that such spines, when present, should be possessed by the female and not by the male; for example, *Chirocephalus spinicaudatus*, Simon, and *Chirocephalus carnutanus*, Brauer (see Simon, 1886, p. 400). These two species are exceptions which prove that the spines have no accessory sexual function as one might perhaps otherwise assume.

A point of more morphological importance is the possession of a marked rostrum. Traces of a rostrum are indeed present in more than one species; for example, *Chirocephalus grubei* (Dybowski) and *Branchipus pisciformis* (Schaeffer). In the latter the rostrum is represented by a broad, truncated outgrowth, and I know of no species in which a definite pointed rostrum occurs like that of *Streptocephalus spinifer*.

Order : Copepoda.

Diaptomus Greeni, n. sp. (Plate II.)

Female; Cephalothorax stout, the greatest breadth falling about the first free segment. The last segment produced on either side into a large wing with two notches (fig. 1). Abdomen consisting of

three segments; the first, or genital segment, very asymmetrical, produced on the left into a simple finger-like process, and on the right into a wing-shaped process with a distinct notch on its anterior margin (fig. 2). Second segment much shorter than either the first or the third, the line of division between it and the latter very indistinct. Caudal rami half the length of the two last abdominal segments combined, very broad and ciliated internally. First antennæ not reaching beyond the cephalothorax. Fifth pair of feet (fig. 3) with the endopodite one-jointed, about two-thirds the length of the first joint of the exopodite, bearing two short spines at its apex. The spinous prolongation of the second joint of the exopodite is nearly straight, and provided internally with a row of minute denticles; a long spine springs from near the base of the joint. The terminal joint very small, having the appearance of a bifurcate spine. Genital operculum with the anterior margin slightly sinuate.

Length: 2·0 — 2·3 mm.

Male; Cephalothorax more slender than that of the female, the last segment not dilated laterally. Abdomen consisting of five segments. The furcal branches somewhat longer than the last segment of the abdomen, narrow, ciliated internally; the outermost seta of the right branch much thicker than the rest, not ciliated, and with a small tooth on its inner side (fig.6). The first antennæ do not reach beyond the cephalothorax. The last joint of the prehensile antenna armed with a small claw, as in *D. denticornis*, Wierz. The two preceding joints are simple, without prolongations (fig.7). The right fifth foot (fig. 8) has the endopodite two-jointed, somewhat longer than the first joint of the exopodite. The first joint of the exopodite is dilated, the last joint long and narrow, with a long terminal claw nearly straight at its base and curved at the end. Near the base of this claw is borne a long spine, bent downwards, and closely pressed to the side of the last joint in such a way as to be scarcely visible when the leg is viewed from in front. This spine, which corresponds to the lateral spine of the ordinary type, is found in this peculiar position in all the specimens, so that the position must be considered normal. In the left fifth foot the endopodite is one-jointed, shorter than the first joint of the exopodite and constricted at the tip. The first joint of the exopodite bears a strong lateral spine and is not distinctly separated from the last joint, which has a folded laminar appearance.

Length: 1·85 — 1·95 mm.

Mr. Green describes the colour: "Body blue, antennæ and forked hinder part extremely red."

The species is remarkable for the strongly asymmetrical expansions of the genital segment of the female, and for the modified seta of the right furcal branch and recurved lateral spine of the right fifth foot of the male. These characters, combined with the armature of the prehensile antenna of the male, make *Diaptomus greeni* a remarkably distinct species.

If we compare it with the four species of Diaptomus previously recorded from Ceylon, viz., *D. orientalis*, Brady, *D. lumholtzi*, Sars, *D. drieschi*, Poppe & Mrazek, and *D. singalensis*, Daday (Table 1), we find that, though these four species form a fairly homogeneous group themselves, *D. greeni* differs very markedly from all, though approaching nearest to *D. singalensis*. On the other hand, in the possession of a hook on the last joint of the prehensile antenna of the male it agrees with *D. denticornis*, Wierz., *D. alluaudi*, Guerne & Rich., and *D. chevreuxi*, Guerne & Rich., three "Circum Mediterranean" species. Tabulating the most important characters of the four species (Table 2) one finds a considerable further agreement, particularly with regard to the prehensile antenna and the fifth foot of the female. The vestigial condition of the third joint of the exopodite of the latter is common among the North American species of Diaptomus, but is otherwise rare. For systematic purposes *D. greeni* may, I think, be classed with the above-named species, and apart from the four remaining Sinhalese species.

TABLE 1.

	D. orientalis.	D. lumholtzi.	D. drieschi.	D.singalensis	D. greeni.
Last segment of the Cephalothorax. × ♀	With small wings	With small wings	Scarcely winged	With small wings	With large wings
GenitalSegment ♀	—	—	—	—	With wings
1st Antenna of ♀ reaches	End of genital segment	End of furca	End of furca	Second abdominal segment	End of Cephalothorax
Last joint of the Prehensile antenna	—	—	—	—	With hook
Last joint but two of ditto	With claw shaped process	With claw shaped process	With a short hook	—	—

	D. orientalis.	D. lumholtzi.	D. drieschi.	D.singalensis	D. greeni.
Endopodite of 5th foot of ♀ compared to 1st joint of Exopodite	Same length	Shorter	Shorter	Shorter	Shorter
3rd joint of Exopodite of ditto	Distinct	Absent	Distinct	Distinct	Vestigial
Endopodite of 5th foot of ♂ compared to joint of Exop.	Same length	Longer	Longer	Same length	Longer

TABLE 2.

	D. denticornis.	D. alluaudi.	D. chevreuxi.	D. greeni.
Last segment of the Cephalothorax. ♀	With large wings	With large wings	With large wings	With large wings
Genital segment ♀	Without wings	With ventral spine	With two dorsal elevations, asymmetrical	With wings asymetrical
1st Antenna of ♀ reaches	Furca	Furca	End of genital segment	End of Caphalothorax
Last joint of the Prehensile antenna	With a hook	With a hook	With a hook	With a hook
Last joint but two of ditto	With a hyaline lamella	Unarmed	Unarmed	Unarmed
Endopodite of 5th foot of ♀ compared to 1st joint of Exopodite ..	Longer	Shorter	Shorter	Shorter
3rd joint of Exopodite of ditto	Reduced	Reduced	Absent	Vestigial
Endopodite of 5th foot of ♂ compared to 1st joint o Exopodite ..	Shorter	Shorter	Shorter	Longer

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EXPLANATION OF PLATES.

Plate I.

Streptocephalus spinifer, n. sp.

Fig. 1—Side view of the female. × 10.

Fig. 2.—Side view of the male. × 10.

Fig. 3.—Frontal process and rostrum of male from the side. × 37.

Fig. 4.—Second Antenna of male. × 37.

Fig. 5.—Leg of 9th pair, male, from behind. × 37.

Fig. 6.—Leg of 6th pair, female, from in front. × 37.

Fig. 7.—Left caudal ramus, male, from above. × 37.

Fig. 8.—Penis of male. × 37

Plate II.

Diaptomus greeni, n. sp.

Fig. 1.—Side view of female. × 48.

Fig. 2.—Dorsal view of abdomen, female. × 57.

Fig. 3.—Fifth pair of legs, male. × 100.

Fig. 4.—Genital operculum, female. × 150.

Fig. 5.—Dorsal view of male. × 47·5.

Fig. 6.—Furca of male, ventral view. × 100.

Fig. 7.—Part of prehensile antenna of male. × 105.

Fig. 8.—Fifth pair of legs. × 100.

Fig. 8*a*—Endopodite of right foot enlarged.

Fig. 9.—Fifth foot of male ; end of last joint of exopodite to show recurved lateral spine.


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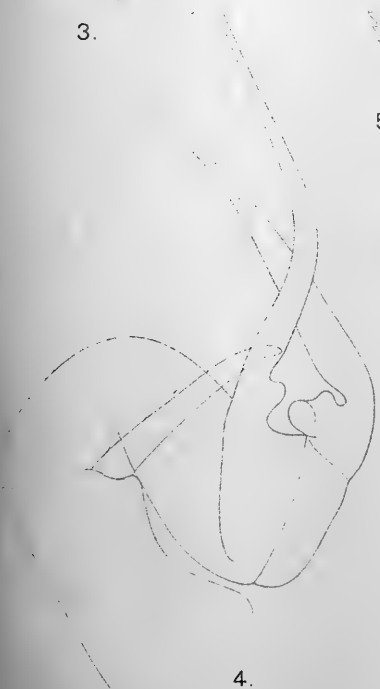
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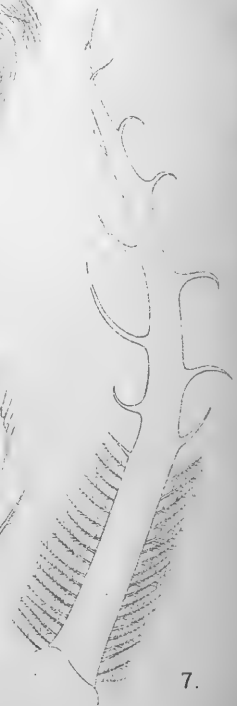
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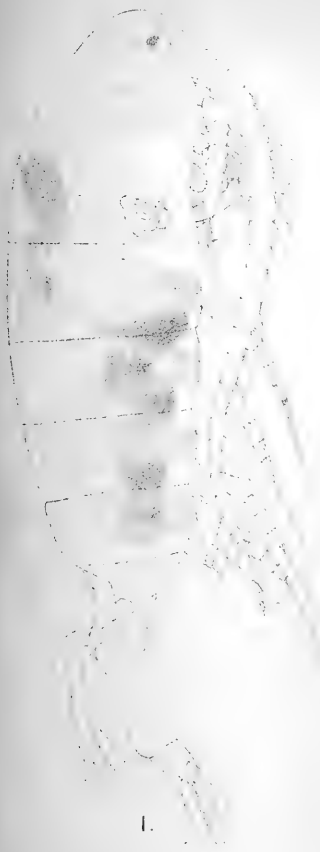
E. W. Sexton and R. Gurney del. E. Wilson, Cambridge.

STREPTOCEPHALUS SPINIFER.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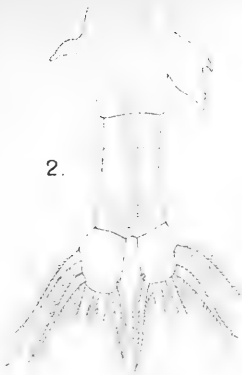
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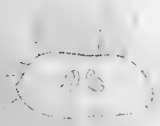
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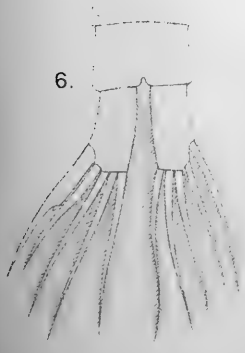
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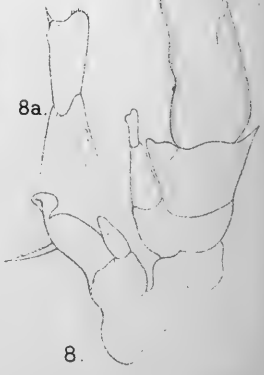
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R. Gurney del.

E. Wilson, Cambridge.

DIAPTOMUS GREENI.

SINHALESE EARTHENWARE.

[Second Paper.*]

By Ananda K. Coomaraswamy, D.Sc.

MR. S. D. Mahawalatenna has kindly forwarded me some traditional verses describing the potters' art and craft. I believe that a knowledge of the crafts was often handed down in such mnemonic verses, preserving the continuity of tradition and ensuring adherence to well-tried and proved methods of work. Mat weavers have craft songs corresponding to this potters song; technical recipes (not only medicines) are sometimes recorded in mnemonic verses, as also are traditional fragments of history, dates of erection of buildings, &c.; instructions for building operations are given in *Mayimataya*, *Gewalshaḍwargaya*, *&c.*, and painting and image making are treated of in *Rúpavaliya* and *Sáriputra*. The two last are Sanskrit works, and the current versions of *Mayimataya* is doubtless a translation from a Sanskrit original. On the other hand I cannot find that any songs exist connected with iron smelting or steel manufacture and many other trades; but this may be because they have been forgotten, or because I have not been able to obtain them.

Of course a song like that here given is of quite a popular character; the Sanskrit works referred to are on a different footing in many respects.

I now give the pottery song, and after it a translation.

1. අරුණට පළමුව පිබිදී පැසගෙණ මැටිපොල දෙසට ය තෙසි
පැස පිසදමලා මැටිපොල පායා ඉවුදෙවියන් වඳී තෙසි
දියකඩ ඇදලා තොසිනි අතටගෙණ වළ ඇතුළට බසි තෙසි
දෙඉවුර නොකඩා මැටිකද බිඳලා පැස සුරවා ගණී තෙසි

2. බිඳලා මැටිකද බැඳගණ බරටම බඩහැළ මිදුලේ ගොඩකර තෙසි
ලිහලා කැට එකවිතරට පොඩිකර මාපැදුරෙ අව්වේ වණ තෙසි
වේලාගණ මැටි ගල්කැට වෙන්කර වනෙන් කොටා කුල්ලෙන්
පොළ තෙසි
පොළලාගත් පිටි එකපමණට දියගහලා අනලා කැටිකර තෙසි

* The first paper will be found in Spolia Zeylanica Vol. IV., pt. XIII., 1906, and should be consulted before the present one is read.

3. කැවිකල මැවිගුළි එකලුඛඑක ගොඛකරම්හ් ඛකොළඅතු ගෙණ වසතෙයි
වහලා තුන්දින හැර තුන්ගොඛකට නැවතත් ගෙණ අන තෙයි
දමලා පමණට ඕන් කුරුදුවැලි ආයෙත් දියගහලා අන තෙයි
අනලා ආයෙත් කැවිකර ගොඛකර තුන්දින හැර ගණී තෙයි

4. මෙසේ පදන්කල මැවි පාගාගණ අතින් නැවත නැවතත් අන තෙයි
ලෙසෙ කතියා ඉවි අත ඇලෙනාකොට තරමට ඇති බව දනි තෙයි
විශේසයෙන් කැවි එක එක තරමට බදුන් පමණ දැනලා කඛ තෙයි
එසේ කැඛි කැවි පවිටල ලඟ අඟුරු සුරුකිව වහලා තඛ තෙයි

5. පසුදින වේවැල් ඉරුවෙන් එක එක කැවිසේ මැවි වෙන වෙන ලියතෙයි
ලියලා කදිමට නැවතත් කැවිකර පෙරදින ලෙස අඟුරු තඛ තෙයි
පසුදින අලියම නැගිටි පවිටල අතුපතුගා පිරිසිදුකර තෙයි
මැවිකැවි එක්කොම අතපස අඟුරු පවිටලමුල ගොස් ඉදඟණී තෙයි

6. එකින්එකට මැවිකැට සුරතට ගෙණ පෝරුව මතු තඛ තෙයි
වමතින් පෝරුව දැන පමණට කරකවමින් දකුණෙන් ඉදිකර තෙයි
බදුන් පමණ හැඛනිල දැනගණ විතෘරට විතරට අත තදකර තෙයි
ඉතින් මෙලෙස පමණට ඉදිවෙනකොට පත්නිල ඛිදලා හැඛගසතෙයි

7. ඛිදලා පත්නිල හැඛලා බදුනේ තදින්ම පෝරුව කරකව තෙයි
ඉදලා ඛිටලා මව්වම බලලා ඇඟිලිතුඩින් ඇදපැද හරි තෙයි
ගහලා දියපොද ඔපලා කදිමට සිරුබලා දෙව්නට ගණී තෙයි
නමලා පමණට ඉදිකර මෙලෙසට තිස්පැය පසුකරලා ගණී තෙයි

8. වමතින් ගලිහැඛ දකුණින් මැවිඅළු බදුන පයට තදකරගණී තෙයි
පමණින් පමණට අල්ලෙන් තළමින් පමණට ලොකුකරලා ගණී තෙයි
මෙලෙසින් විතරට ලොකුකර තළලා ඔපලා අව්වේ වණ තෙයි*
වේලා පමණක් ලියවැල් මල්වැල් මල්පෙති බදුනේ වට අඳි තෙයි

9. ඇඳලා වට ඉරි මල්පෙති කුකුළන් ගිරා පරෙයි සැලලිහිණියනු න්
ඛිදලා පත් බෝපෙති වදු මල් ඉදිවදු නාමල් ඔදු නෙළුම්මදු න්
සඳලා වන්දා, සූරියමණ්ඩල මකරතොරන් රණ හංසයිනු න්
නුමුලා ඇත් අස් ගව මෘග සිංහ දිවි වඟවලසුන් නා පොලොං රුව න්

10. පිනන තිසරුන් ඉගිලෙන ලිඛිණීන් රුබර කිඳුරන් මී ඛඛරු න්
දුර පිඹුරු නෙක ගෝර සපුන් ඇති මෝර කැසුප් සහ රණමසුර න්
මෝරණ රණහස සේම දිනෙන්දින ආරණ තන ඇති කොමල උදු න්
නැර මෙරු සුරතල් ලම පැවියොත් බදුන් වවේ කරලා එතල න්

11. නාරි ලතාවැල් ලියවැල් වට ඇඳ සෝඛියෙකුරු පිල්ලම් ඇඳ ලා
ත්‍රිශූලම් මැඳ ඕං ක්‍රීං ඝර ආරක්සාවට පිඛිටුව ලා
මසුර නාග හංස උරඟද ඇ සිව් සූවිටු සිවිකොණ ඇඳ නිම ලා
මණ්ඩල නවග්‍රහ රාසි දෙලස සත්විසි නැකතුත් එකි පිඛිටුව ලා

12. පාට කදිම ගුරු මකුළු සොයාගණ උකුපමණට දියකරගණී තෙයි
ඊට මාත්තුව තෙල්වලි දිලිසෙන පමණට මුසුකරලා ගණී තෙයි
මිට පසුව අව්වේ වණලා සොඳටම වේලාගණී තෙයි
ඊට පසුව ගිනිපවිටලා අඟුරු පළමු දිනේ දුන්වද දව තෙයි

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* This line is short : some word seems to have been omitted.

13. දෙවනු දිනෙ පමණක්දර දමලා පමණක් ගිනිදල්වා තබ තෙයි
තෙවනු අිනේ තරමට ගිනිකරලා පදමට එන්නට පාදව තෙයි
ඊට පසුව ගිනි ඇදලා නිවලා නිවෙන්ඩ තුන්දින පසුකර තෙයි
සිව්වෙනි දින පට්ටල නිවුනා දැන බඳුන් එකින්එක ගෙණ බා තෙයි

1.

Waking before the dawn, carrying the basket, he fares to the place-of-clay ;
After cleaning the basket and clearing the place-of-clay, he worships his guardian god ;
Wearing (only) a loin cloth, and gladly taking (the basket) in hand he goes down into the pit ;
Not breaking down the two sides (of the pit) he digs the clay from the middle and fills the basket.

2.

Breaking up the clay, he takes a pingo-load and heaps it in the potter's yard ;
Separating the pieces of clay he breaks them to an equal size and spreads them on a big mat in the sun ;
After having dried the clay, and removed the stones, he pounds it in a mortar and in a *kulla* winnows it ;
Then taking up the powder, he adds an equal quantity of water and makes it into balls.

3.

Taking up the balls of clay and putting one upon the other, he covers them with leaves ;
Three days afterwards he divides them into three and kneads them again,
Knowing the right proportion he adds very fine sand and sprinkling water kneads again ;
After kneading, he makes into rounded balls again, and makes a heap of them ; and takes them up again after three days.

4.

After thus preparing it, he treads and kneads the clay again and again ;
When it is like sticky wax he knows that it is ready ;
Then according to the size of the vessels to be made he divides it into separate pieces ;
The pieces thus made he stores near the workshop and covers up carefully.

5.

Next day with a split cane he separates the pieces of clay one by one,
And having duly divided them, again makes them up in balls and keeps them in a heap as on the previous day ;
The next day, waking at dawn, he sweeps and tidies the workshop,
And having all the balls of clay close at hand, sits before the wheel.

6.

He takes with the right hand the balls of clay one by one and sets them on the wheel,
With the left hand he turns the wheel,* with the right hand he moulds (the vessel),
Knowing the size and shape (required), as required he presses down the hand;
Then when the right shape appears, he stays the form, and moulds the rim.†

7.

Having stayed the form and turned the rim, he turns the wheel very fast,
And looking now and then to see if it is smooth, he amends with the finger tip any unevenness,
Sprinkling a little water he polishes (the pot), then takes it carefully with open hand,
Duly keeps it standing by, and takes it up again after thirty hours from the time of making thus.

8.

(Then) taking the *galiheḍa* ‡ in the left hand and the *meṭi aluwa*§ in the right, holding the vessel tightly with the feet,
He beats it with the blade,‖ making it bigger as much as need be,
And after thus beating it to the required degree and having polished it, he sets it in the sunshine,
After it is partly dried, he draws leafy creepers (*liyawel*), garlands and flower-petals round the vessel;

9.

Having drawn round it lines, flower-petals, cocks, parrots, pigeons, *seḷalihiṇi*,
Separately (he draws) *bó* leaves, flower bunches, date bunches *ná* flowers, *ólu* and lotus flowers,
And makes the orbs of sun and moon, *makara toran* and golden *haṉsa*,
Elephants, horses, cattle, deer, lions, tigers, wolves, bears, cobras, (*poloṉgas*).

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* Usually the wheel is turned by a young assistant.

† *Heḍagahasteyi*; *i.e.*, he moulds the rim with a wet rag, turning it over.

‡ Stone held inside the vessel while the sides are hammered over till they meet; see previous paper, fig. 1.

§ *Méṭi aluwa*, evidently another name for the bat, *walantalana leḷla* of previous paper, fig. 1.

‖ *Alla*, lit. palm of the hand, doubtless means the blade of the bat or *walantalana leḷla*; the description previously given should be carefully read to make the meaning of this verse clear.

10.

Swimming cranes,* flying *lihiṇi*, fair *kiñduro*, and honey bees
Great boas, fierce serpents not a few, sharks, tortoises, and golden peacocks,
Beautiful damsels whose ever-swelling breasts are like growing golden swans,
Nor does he forget to draw dear delightful children.

11.

Having drawn round it *nári latà*, *liyawel*, and also the letters of the alphabet with vowel signs,
And inserting in the midst a trident with the signs *óṁ hriṁ* as a talisman,
Having well drawn in the four corners *púṭṭu*†, peacock, cobra, swan, serpent.
The signs of the Zodiac, the nine planets, and the twenty-seven asterisms. ‡

12.

For this) he takes good (red) *gurugala* and (white) *makulu* and mixes them with water to a thick consistency,
Mingling them with the right amount of oil, that they may shine :
Thereafter he sets them in the sun to dry them well,
And after that having stocked them in the kiln, on the first day he dries them in the smoke.

13.

On the second day putting only a certain quantity of firewood he lights a moderate fire,
On the third day he makes the fire strong enough, and fires (the pots) till they are done ;
Afterwards he draws away § the fire and puts it out and leaves there three days for cooling,
On the fourth day ascertaining that the kiln is quite cool, he takes out the vessels one by one.

Before concluding these notes I make a few additions to and note a few errors in my former paper.

Earthen vessels occasionally made, beside those mentioned, are spittoons (*paḍikkam*) and one-handled mugs (*púkuru*).

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* *Tisaru*, cranes (?) ; *haṇsa* I have translated as swans.

† *Púṭṭuwa*, a symmetrical arrangement of two, three, or four animals with necks entwined.

‡ The poem mentions a long list of decorations, some of which could hardly be found room for on an earthen vessel. All the work referred to is of the kind done before firing, and does not include painting, which (except slip painting) is no part of the potters' art.

§ The firewood is in the form of long sticks which are pushed in as they burnt away ; hence the expression " to draw away the firewood " when the fire is to be put out.

A *kalaha* is a vessel open at both ends, and resembling a *kalageḍiya* with an extended neck; *kalas* are used for holding sprays of coconut flower on auspicious and ceremonial occasions (weddings, *maṅgalya*, &c.) a pair being placed on the two sides of the doorway. This is however a special use of the word *kalaha* (*kalasa*, *kalaya*) which is equivalent to Sanskrit *kalasa* or *ghaṭa*, and generally applicable to vessels with only one opening, especially those of *kalageḍiya* type.

A particularly interesting piece of earthenware is the *bummeḍiyâ* (which may be translated "bullfrog"). This is a vessel open at both ends like a *kalaha*, but the difference of diameter between the two ends is greater; there is a large belly as in a *kalageḍiya*; the large end is covered with a *talagoyâ* skin (attached with paste made from *habaralissa*, or from rice and plantain), and a strap is added for hanging over the shoulder. The drum so made is used at harvest times and for *lîkeliya*.

Large vessels with lids, formerly used for holding cloths (garments), are called *piḷiheḷiya* and *haluheḷiya* (the latter if smaller); cloths were considered to keep well in earthen vessels, and to be better protected from the attacks of insects than if kept in wood boxes.

Smaller vessels of the same general type, decorated with cobras, are used in Pattini Déwâla to hold the *halaṁba*, and are called *halaṁbaheḷiya*. Similar vessels without cobras are used for betel leaves and called *bulatheḷiya* or *heppuwa*.

A curious variety of *kotalaya* is the ring-shaped *walalu kotalaya*: these have to be inverted and filled from underneath. The same arrangement is sometimes found in the case of a *kotalaya* of the ordinary form, then called *yatura kotalaya*.

It is noteworthy that the Kẹḷaṇi money boxes are in the form of a *mamma*. This is a world-wide and very old form for a money box, the idea being the suggestion of abundance and plenty. It is, in fact, sympathetic magic.

It should have been remarked that at Kẹḷaṇi the white material is rubbed into the incised lines after firing. This is different from slip painting, which whether red or white (which last I have not seen, but which is referred to in the verses) is done before firing. The different patterns used at Kẹḷaṇi have no special names.

New pots are generally seasoned before use, by inverting over a small fire and so smoking them, after which they do not communicate a raw taste to the water held in them.

Besides the big *pátras* used in vihára, smaller earthen alms-bowls are made, though the alms-bowls actually used by priests

are usually metal. Some potters (at Kelaṇi) make an alms-bowl for presentation to a priest, with every batch of pots turned out.

A good deal of pottery in Colombo is nowadays imported from Southern India. The Tamil earthenware is considered of very good quality.

The *Kárti Maṅgalya*, incorrectly spelt *Kaṭṭi* on page 4 of the previous paper, has no connection with the presentation of robes, but is the Siṅhalese festival corresponding to the Hindu Dípavali, when innumerable lamps are used.

For *púnákalé* (p. 16), *púnáwa* is a more usual term.

For *úrákoṭṭa*, (p. 11) read *úrákeṭa*; the *úrákeṭa* are usually of wood, hollowed segments of a large tree.

On page 4, note, the right word is no doubt *táliya*.

Finally, I shall be very grateful for any further corrections or additional information.

NOTES.

1. *Costume of Sinhalese Ladies before the Portuguese Period.*—What is now known in Ceylon as the Aryan dress was the costume of Sinhalese ladies before the arrival of the Portuguese. The adoption of Christianity and the free social intercourse which existed between the Portuguese and Sinhalese gentry in the sixteenth century led to its abandonment in the low-country, while the influence of the later Tamil dynasty on the Kandyan throne led to its modification in the Kandyan provinces.

The Sinhalese poem, "Selalihini Sandesa," written in the reign of Prakrama Bahu VI., early in the fifteenth century, likens the lake in Cotta to a lady in the following words (Macready's translation):

> "The basin there, lake Diawanta called,
> Aye represents the fair silk robe that wraps
> The lady city, with its heaving folds
> Of waves, with its long shaking girdle cloth
> Of splashing foam, with rows of lilies red
> Inwrought, and golden likeness of the swan."

Thus comments Macready:—

"The poet likens the sheet of water in front of the city to the dress of women, as it then was; which consisted of a long cloth (often figured with devices such as the lotus and the hansa) wound round the body and folded thickest at the waist. One end was drawn up, and allowed to fall in pleats over the portion that served as the waist band."

C. M. FERNANDO.

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2. *Waterholes.*—The low-lying flat country which lies between the foot of the Matale hills and Jaffna, extending to the coast on either side, is almost entirely dependent on artificial irrigation and on wells for its water supply. Before its occupation by a race skilled in the building of tanks it was for half the year destitute of water, save that to be found in a few rivers which flow throughout

the year, in a few vil or natural lakes, in the sandy beds of rivers where the animals dig for water, and in a large number of rock water-holes. From their wide, almost universal, distribution, these last must be considered as the most important of the several sources.

Now that the great irrigation works of the Sinhalese have been breached and have lapsed into forest, the conditions of the wilder parts of the country is the same as it was 3,000 years ago; and the animal population of the forests is again largely dependent for its existence on the water which lies in the deep holes in the rocks. These holes, which are of so great importance to the animals, are not all alike; for some are large enough and shallow enough to permit of buffaloes wallowing, while others are so small that a bear can hardly crawl in far enough to slake his thirst. But the large shallow ones do not survive a prolonged drought, and eventually the thirsty denizens of the forest are reduced to seeking their drink in a few deep narrow holes, the area of which is so small proportionately to their cubic content that even the driest year leaves them unexhausted.

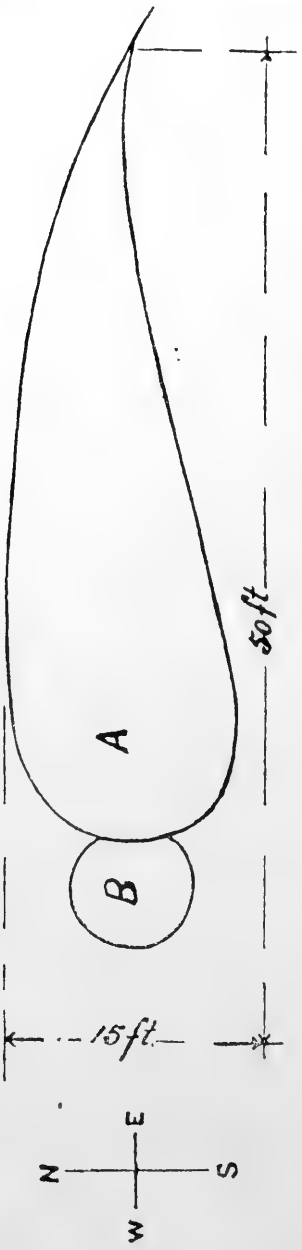
These holes are, as a rule, situated in the middle of great spaces of slab rock (gneiss), which provides a catchment area large enough to fill them from a few heavy showers. One side is generally higher and steeper than the other, so that access to the water is only possible at one or two spots.

Some of these holes are very deep with nearly precipitous sides, and when thirsty animals and evaporation have reduced the water below a certain level, it is exceedingly difficult for any animal to quench his thirst save at great risk of falling in. Into the traps thus formed animals do sometimes fall and are unable to escape.

I was once brought some of the teeth of a bear which had been found a mass of corruption in a nearly-dry water-hole. On another occasion I saw the bones of deer which had been dug up in the mud at the bottom of a hole which elephants had drunk dry. And during last year (1905) there were no less than three instances in the North-Central Province of elephants being thus entrapped. A cow elephant and her calf were successfully removed from one hole and led away captive, already half tamed by their trying experience. Of these captive elephants I was lucky enough to see one a young female about 5 ft. at the shoulder.

The hole which was her prison lay in the centre of a wide expanse of slab rock some two acres in extent. It was about 50 ft. long by some 15 ft. in breadth, and when I saw it contained 2 ft. of water.

The following diagram shows approximately the shape :—



The hole A was that in which the elephant was captured. B was a small pocket at a higher level and contained clear water. The north side or wall of the hole was some 12 to 15 ft. above the level of the water, and the south side about 6 ft. with a sloping lip. It was down this lip, polished by generations of thirsty beasts to a slippery smoothness, that the poor elephant had slid.

She walked ceaselessly up and down uttering little unhappy noises, and continually trying to grip the smooth uncompromising stone with her trunk, which was quite worn and torn by constant beating on the rock. Sometimes she got wedged into the narrow end, and with her feet against one wall and her back against the other tried to climb out. Occasionally she would succeed in rising a foot or two but always to fall back again more angry and miserable than before. By this climbing process her rump had become quite worn and sore. Although, judging by the droppings of the herd, she had been four or five days in captivity, she was no whit sobered, but charged to the end of her prison whenever I approached.

Any branches I gave her for food were immediately trampled under foot. Some attempt was made by the Ratemahatmaya to get her out, but after some ten or twelve days' captivity she died.

JOHN STILL.

Anuradhapura, August 9, 1906.

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3. *Eagle's Nest at Peradeniya.*—On April 10 I noticed a large nest composed of coarse sticks placed on the extreme top of a Bombax tree in the Botanic Gardens here. The tree was quite leafless, and the bird, an eagle of sorts, was perched on the edge of the nest. I believe the bird to be *Spizaetus ceylonensis* (the smaller crested eagle), examples of which have been seen about the Gardens not infrequently. I was rather surprised at the very open and conspicuous situation of the nest, but a fortnight later it was entirely concealed by the new growth of foliage. It seems probable that the site was chosen while the tree was in full leaf, the subsequent seasonal fall of leaf exposing the structure for a short time.

E. E. GREEN.

Peradeniya, June 19, 1906.

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4. *A Copy of the "Mahawansa" in Cambodian Characters.*—Ola manuscript C 7 of the Colombo Museum, being a copy of the Mahawansa in 13 parts in Cambodian characters,* was recently lent to Professor Geiger of Erlangen University for the purpose of compiling his critical edition of the older portion of the Mahawansa.

* Presented by the British Consul at Bangkok, Colombo Museum Catalogue of Manuscripts, 1901, p. 17.

Prof. Geiger supplies the following descriptive note upon the manuscript :—

"It does not contain the original text of the Mahawansa, but an enlarged one. This secondary Mahawansa was first found by the late Prof. Hardy in a Cambodian manuscript kept in the National Library at Paris (*vide* J. R. A. S. 1902, p. 171). I am inclined to believe that all the Mahawansa manuscripts written in Cambodian characters contain the same enlarged text. This is, no doubt, the case with the other Cambodian Mahawansa manuscript kept in the Museum's Library. I conclude it from the information which I got about it from my friend the High Priest Subhuti, who has examined the manuscript.

"2. The writing of lot 1 is tolerably clear and legible. Its text is better and much more correct than that of the Paris manuscript.

"3. It consists of 13 sets of olas comprising 24 olas each. The second set contains 26 olas; the last two olas are signed  and  (ira and irá).

"The first two leaves of the third set bear the same signature. The eighth set comprises only 19 olas. But this set is misplaced. It should be put at the end of the whole manuscript as 14th set, for it contains the last chapters of the Mahawansa from XXXV. 21 to XXXVII. 50 and the author's subscription. The author calls himself Puggallano (in the Paris manuscript Moggallano). The true 8th set is entirely missing comprising the olas  to  (na, tah), and, in the Mahawansa a passage from chapter XXII. to the beginning of chapter XXV. It may be remarked that the set 8 (= *recte* 14) is not signed in the same manner as the leaves of the other sets."

Erlangen, December, 1905.

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5. *Latin Derivatives in use in the Sinhalese Language.*— The few Latin derivatives in use in the Sinhalese language are due to the introduction of the Roman-Dutch Law into the maritime provinces by the Dutch. Of course there are a number of Sinhalese words which can be traced to Latin through Portuguese, being directly adopted from the latter. The following words however were taken into Sinhalese from their Latin equivalents in the Roman-Dutch jurisprudence :—

"Peracoduru," proctor from the Latin "procurator."

"Peracalasiya," proxy or power of attorney, is the Latin "procuratio."

"Citasiya," or summons, is from "citatio."

"Cuitansiya," voucher or receipt, is from "quittance" (Latin quittare).

"Conseduva," court or courthouse, is from "consedium."

"Petisama," petition, is from "petitio."

"Ensenevasiya," letter of demand, is a corruption of "insinuatio;" while "eskisiya," writ, is a corruption of "executio."

"Pimbura," plan, or figure of survey, is a corrupted form of "figura;" and "vidacomis," entail, can be traced to "fidei commissum."

C. M. FERNANDO.

THE SIGN OF THE TORTOISE, OR KURMA-CHAKRA, IN CEYLON.

By A. WILLEY, D.Sc., F.R.S.

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THE Colombo Museum has recently come into the possession of a set of native medical appliances of sufficient interest to merit a separate report. The principal piece in the set is a low stone bench upon which is incised, in a conventional manner, the contour of a tortoise. Such representations of animals in the primitive art of various countries have a peculiar fascination, not only because they illustrate what has been called the evolution of decorative art, but because they are, in many cases at least, the visible and tangible reflection of the inner life of the people.

Fishes, lizards, snakes, birds, and certain mammals are commonly met with in the early stages of artistic design. Generally their use is primarily symbolical, as, for example, when they represent the vehicles and *avataras* of the gods; from this state they may pass by easy gradations into a frankly decorative condition. Sometimes their import is more strictly utilitarian, as is the case with the *Kurma-chakra* in Ceylon, a *yantra* which carries healing in its lines.*

Before describing the actual objects with which this note is concerned it may be useful to give some references and experiences in evidence of the widespread traditional importance of the tortoise. In spite of limited time, literature, and knowledge at my disposal, I think these will be enough for the purpose in view, namely, to illustrate the hold possessed by this particular type of animal life upon the unfettered imagination of the peoples of the earth.

In the premises of large Hindu temples there may be seen a stone edifice called a *mantapam* consisting of a bare roof supported by more or less richly carved pillars varying in number from four to one thousand. At Little Conjeeveram, a hamlet situated a short distance from the town of Conjeeveram in Southern India, which is reputed to be a halting centre for Kasi Brahmins bringing Ganges water from Benares to Rameswaram, there are two 4-pillar *mantapams* to receive Vishnu and Lakshmi respectively, and a 100-pillar

* A *yantra* is a mystical device; a *mantra* is a mystical formula; a *sastra* is a mystical code or system of rules relating to the application of *yantras* and *mantras*.

mantapam containing the throne-dais of the Perumal borne upon the back of a colossal tortoise. I had the good fortune to visit this place at the beginning of 1905 and took particular note of the *Kurmasana* or tortoise throne.*

The *Kurmavatara*, or tortoise incarnation of Vishnu, which is frequently presented in the form of ivory statuettes and in damascene work as in the *kuftgari* of Travancore, is the third of the regular series or the eleventh of the extended series according to the Bhagavata Purana, where 22 *avataras* are enumerated, and is the subject matter of the Sanskrit writing called the Kurma-purana. "In his eleventh incarnation, the Lord in the form of a tortoise supported on his back the churning mountain [Mandara] when the gods [Suras] and Asuras were churning the ocean." †

In the earlier mythology we learn that Prajapati, who issued from the golden egg of Brahma, was similarly transformed: "Having assumed the form of a tortoise, Prajapati created offspring. That which he created he made (*akarot*); hence the word *kurma*. *Kasyapa* means tortoise; hence men say all creatures are descendants of *Kasyapa*."‡ From this quotation it appears that there are two Sanskrit words meaning tortoise, the one (*kurma*) designating the real tortoise, the other (*Kasyapa*) being a personal appellation.§

Among the translations from the Pali of "The Jataka or Stories of the Buddha's Former Births" are included several tortoise manifestations or Kacchapa-jataka.‖

It is not only in Hindu cosmogony that the tortoise has been employed as a symbol of mundane and celestial power and influence. In discussing the origin of the rock engravings or petroglyphs of Guiana, Sir E. F. im Thurn¶ referred incidentally to "some picture-writing from a rock near Lake Superior, in which are rudely represented five canoes, containing in all fifty-one men, a kingfisher, a man on horseback, a land tortoise, and a figure made up of three concentric semicircles arched over three small circles." In this drawing the tortoise denotes land which was reached by the canoes

* Compare *Simhasana* or lion throne of a high priest, so called "from the figure of a lion on the back of the seat." See editorial note on p. 128 of "Hindu Manners, Customs, and Ceremonies," by the Abbé J. A. Dubois, Oxford, 1899, translated and edited by Henry K. Beauchamp. The word *asana*, meaning a seat, is written *asna* in Clough's Sinhalese Dictionary.

† J. Muir. Original Sanskrit Texts, vol. IV., 2nd edition, 1873, p. 27. See also Christian Lassen, Indische Alterthumskunde, Bd. IV., Leipzig, 1861, p. 580. *Kurma-raja* is the tortoise supposed to uphold the world (Monier-Williams, Sanskrit Dictionary).

‡ J. Muir, *op. cit.*

§ See Angelo de Gubernatis. Zoological Mythology, vol. II., 1872, p. 360, where the tortoise is called the "Lord of the Shores."

‖ The translations are published by the Cambridge University Press under the editorship of Professor E. B. Cowell; see vol. II., translated by W. H. D. Rouse, 1895, Nos. 178, 215, and 273.

¶ Among the Indians of Guiana. London, 1883, p. 404.

in three days "signified by the accepted sign of the heavens arched over three suns."

In the popular mythology of Japan* the tortoise is the servant of Kompira, a Buddhist divinity identified by Shinto with the god Kotohira. If a pious fisherman finds a tortoise he writes upon its back characters signifying "Servant of the Deity Kompira," gives it a drink of *sake* (rice wine) of which it is said to be fond, and sets it free. Some say that the land tortoise or stone tortoise [compare Sinhalese *gal-ibba*] only is the servant† of Kompira, the sea turtle being the servant of the Dragon Empire beneath the sea, the latter having power to create with its breath a cloud, a fog, or a palace. It figures in the Japanese Fairy Tale of Urashima. Tortoises have been known to live for several centuries, and in Japan it is supposed that they live for a thousand years; they are therefore one of the most frequent symbols of longevity in Japanese art. The tortoise commonly represented by native painters and metal-workers has a fringe of tails trailing behind, like the fringes of a straw rain coat or *mino*, whence it is called *minogamé*. Mr. Hearn adds that some of the tortoises kept in the sacred tanks of Buddhist temples attain a great age and acquire a coating of water plants which stream behind them; the *minogamé* is said to have had its origin in this circumstance.

Tortoises and turtles constitute a well-defined order of reptiles comprising species which inhabit the dry land, fresh water rivers, lakes and tanks,‡ and the sea. They are distinguished by the possession of a dermal skeleton arching over the body, beneath which the head, limbs, and tail may be more or less completely retracted. The upper portion of this long shield is called the turtle back or carapace; it presents a characteristic rounded contour capable of easy delineation.

In consequence of the diversity of their mode of life and also of their geological age, the Chelonians are widely distributed over the surface of the globe; the order is virtually cosmopolitan and known to all mankind. On account of their peculiar form, their relative invulnerability, sluggish, persistent habits, their fecundity, and long life, it is not surprising to learn that they appear in many guises in the folklore of the world.§

* My information on this subject is derived from the late Lafcadio Hearn's "Glimpses of Unfamiliar Japan," Boston and New York, 1898–1899, vol. II., p. 367. I have closely followed the original phraseology.

† By "servant" is no doubt meant "vehicle."

‡ It is well known that the fresh water species exercise a scavenging and purifying influence in the waters where they abound. Sir Emerson Tennent notes that in Ceylon they are sometimes placed in wells to keep the water pure. For the same reason the tortoises of the Ganges are held to be sacred.

§ Professor Gubernatis (*op. cit.*) states, *inter alia*, that "the Romans were accustomed to bathe newborn babes in the concavity of a tortoise, as if in a shield."

The stone bench or *gal-bankuwa*, which I have set out to describe in the hope that it may be considered worthy of the attention of ethnologists, is called in colloquial Sinhalese *ibba-bankuwa*, because it bears upon its surface the symbol of an *ibba* or land tortoise.*

In the learned tongue of Ceylon it is known by the Sanskrit name *Kurmasana*. The sign which it bears is called in astrological language the *Kurma-chakra*,† and this is supposed to possess the virtues of a *yantra;* in other words its meaning is that of a *yantra*.‡

According to my informant, who was a professional Kattadiya or Kattadirala, a dealer in *mantras*, the Vedarala or native herbalist, surrounded by his utensils and medicaments, would seat himself upon the tortoise bench, repeat Sanskrit verses, and then begin to prepare the medicine, having previously ascertained an auspicious day. The *Kurma-chakra* is said to be very useful both to man and animals in promoting their recovery from sickness; instructions regarding it are contained in an ola (palm leaf) manuscript entitled "Maha-narayana-pota," from which the Kattadiya read an extract in which the chakra (symbol) was mentioned. On another occasion he brought a manuscript called "Merutantra" which contained preliminary instructions for the use of *yantras* and *mantras* proceeding from *Kurma-chakra*. At least 108 *yantras* and *mantras* are said to belong to this series; each sickness has an appropriate *yantra*, and all the *yantras* which proceed from this *chakra* are included under the collective term *Kurma-sastra*. The *yantras* are applied through the medium of the *mantras*, and I should say that the *chakra* may be regarded as the vehicle of the *yantras*. So far as I can gather, the *Kurma-chakra* is the fountain of all astrological lore in this Island; all important operations must be performed through it, and an astrologer who does not know it is not a learned man.

With regard to the actual *Kurmasana*, I have no means of knowing to what extent it was formerly used by Vedaralas in Ceylon. It appears not to be a common object of the country side. If it had been commonly employed, some mention of it would have been expected in the pages (246–251) devoted to Astrology and Medicine in Dr. John Davy's "Account of the Interior of Ceylon" (London, 1821), but there is none.

The material of which the seat is composed is a kind of compact

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* The marine turtle is called *kesbewa*. At Kurunegala there is a rock called Ibba-gala (see F. H. Modder. The Animal-shaped Rocks of Kurunegala, Journ. R. A. S. Ceylon, vol. XI., 1890, p. 377).

† In the Sanskrit Dictionary (Monier-Williams, 1872), *Kurma-cakra* is defined simply as "an astrological diagram." Besides its simple meaning (tortoise, turtle) the word *kurma* also signifies "the earth considered as a tortoise swimming on the waters."

‡ Compare the Melanesian conception of *mana*. (Rev. R. H. Codrington. The Melanesians: studies in their Anthropology and Folklore. Oxford Clarendon Press, 1891, pp. 118–119.)

laterite. One end of the seat, which may be the front end, projects about two inches beyond the level of the feet; the sides are slightly concave (figs. 1 and 2).

The dimensions are the following: length 15½ inches; width at each end 7½ inches; width across the centre 6½ inches; height

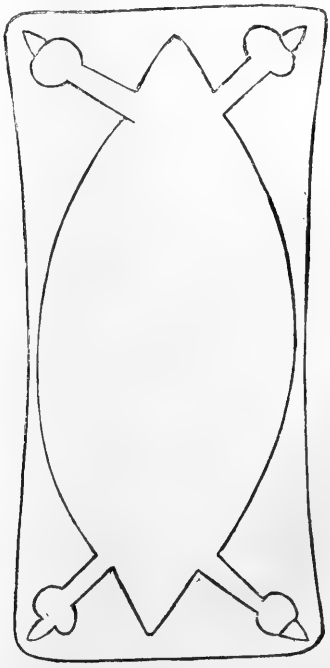

FIG. 1.—SURFACE OF TORTOISE BENCH.

FIG. 2.—THE BENCH IN SIDE VIEW.

about 4½ inches. The height will appear low for a seat, but it should be remembered that it is adapted to the old sitting posture. The form of the symbol and other details are clearly shown in the figures and require no lengthy description. In zinc blocks it is well known that accidental irregularities are often exaggerated while real angles are suppressed. The lines which shut off the claws from the rest of the limbs in fig. 1 should be slightly angular with the apex pointing towards the body, not straight.

Accompanying the seat was a heavy stone mortar for crushing dried roots, a copper cauldron, a root-cutter, and an iron style. The mortar is a massive oblong block of stone with deeply hollowed ends and four ellipsoidal slightly depressed grinding surfaces; it measures $16\frac{1}{4}$ inches in height, nearly 10 inches across, the terminal holes 7 inches in diameter, one of them $4\frac{1}{2}$ inches, the other $3\frac{1}{8}$ inches deep; it is called *behet ambarana kotana gala*, meaning "medicine grinding pounding stone;" the *at-gala* or hand stone (seen in the mortar in fig. 3) is a combined pounder and roller for the preceding.

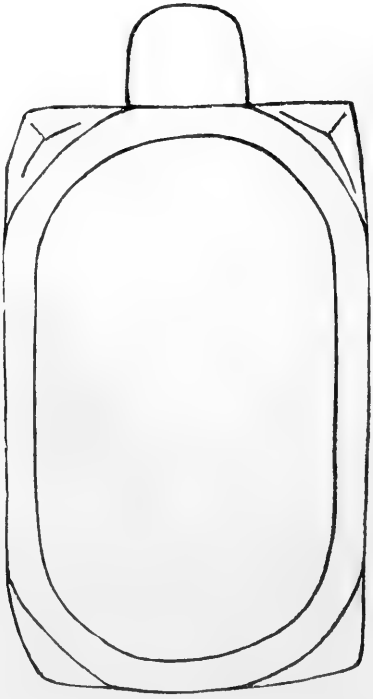

FIG. 3.—STONE MORTAR.

The cauldron or *tachchiya* is a round copper basin nearly $21\frac{1}{2}$ inches across, $5\frac{1}{2}$ inches deep, with iron handles but no distinguishing mark. Another one brought later to the Museum measured nearly $19\frac{1}{2}$ inches across, $7\frac{1}{2}$ inches deep, with brass handles and the mark of a dagoba or *kota* impressed beside one of the handles.

The root-cutter or *behet kapana giraya* is a common object of crude construction.

What, to my mind, adds considerably both to the comparative importance and to the local interest of the *Kurma-chakra* is the fact that it is frequently to be seen branded upon the backs of the black draught bulls of Ceylon, as well as on cross-bred cattle, always across the sacral region. In the Journal of the Ceylon Branch of the Royal Asiatic Society for the year 1873 there is a Paper entitled

"Brandmarks on Cattle," by Mr. James de Alwis (see p. 60). This Paper deals only with such marks as vary according to the caste of the owners, and there is no mention of those florid designs which are commonly branded across the haunches of the bulls.

Having searched in vain for any reference to an *ibba* mark on cattle, I made independent inquiries and ascertained that it has been the custom to brand the sign of the tortoise on the backs of sickly bulls and on bulls which have been through the old operation of *kara-ambanawa* or gelding by crushing.

In fig. 4 I give a sketch showing the position of the marks on a bull which was brought to the Museum for my inspection.

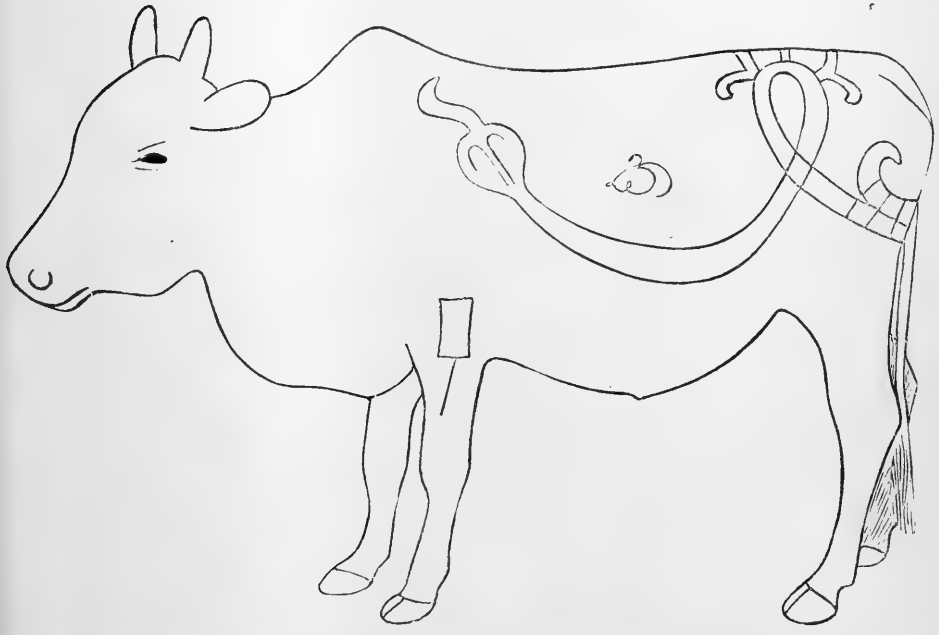

FIG. 4.—A CEYLON BLACK BULL WITH BRANDMARKS.

In this example the mark on the haunch and side forms a loop over the hip joint and is connected with the *ibba* mark above. The long mark at the side with a peculiar expansion near the shoulder is called *rena;** above it appears the letter K, the initial of the owner, who was a member of the Potters' caste whose cognizance, called *meti-alla* (clay mallet), is seen on the left fore limb.

* I am strongly inclined to think that this is a *naga* or cobra derivative, but the men who came with the bull would only admit the term *rena*, which means a long cord or rein.

The tortoise brand seen from above is shown in fig. 5, where the curved processes in front and behind represent the four legs; the total length was about a foot and the inside width across the centre $4\frac{1}{4}$ inches.

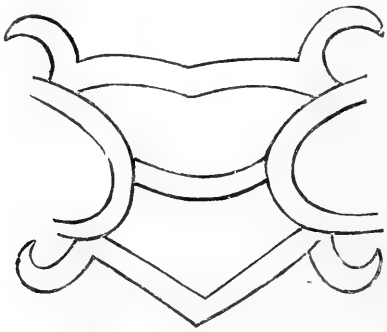

FIG. 5.—TORTOISE BRAND.

As with all individual handiwork the same pattern is probably seldom or never exactly repeated, so that there are innumerable variants, one of which is shown in figs. 6 and 7.

Below the *ibba* mark in fig. 6 and separated from it, there is the semblance of a bo-tree (*Ficus religiosa*). The bull from

FIG. 6.—SIDE VIEW OF BRANDMARKS OF ANOTHER BULL.

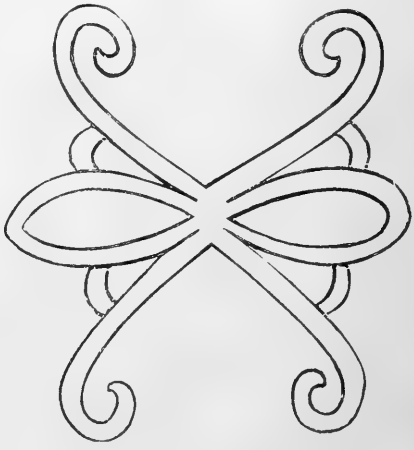

FIG. 7.—TORTOISE BRAND FROM ABOVE.

which these sketches (figs. 6 and 7) were taken was accompanied by another in the same cart which had not received the tortoise brand.

In a variant of the type shown in figs. 4 and 5 only the loop of the *rena* remained as a lateral appendage of the *ibba*, the rest of the

rena being omitted. Sometimes it may be observed that the hook-shaped legs have disappeared from the brandmark, which is then reduced to four ovals meeting in a centre, forming a cruciform pattern.

These singular designs on cattle bear little enough resemblance either to a tortoise or to the sign on the bench described above, but this circumstance depends no doubt to a large extent upon the nature of the materials, the surfaces upon which the symbols are delineated, and the tools employed. The marks on the bulls partly follow the natural curves of the body and partly depend upon the shape of the branding irons. In all cases the constancy in the position of the *ibba* brand, across the loins, is a point to be noted.

FURTHER NOTES ON THE HYBRIDIZATION EXPERIMENTS WITH THE CEYLON JUNGLE FOWL.

By J. Llewellyn Thomas, F.R.C.S.Eng.

THE previous article on this subject brought the experiments up to the date of 1st June, 1906. This present note brings them up to 1st June, 1907.

One or two omissions in the first report have been pointed out by some of the experimenters, and must be recorded here as they have a bearing on the claim of the *Gallus Stanleyi* to recognition as a primitive stock of domestic fowls. Further, since the publication of the first report, success has been achieved which alters the whole aspect of the question. To deal with the two omissions: first, one of the experimenters, Mr. Clement Johnson now in England, has written giving information regarding experiment *No.* 5, *Hybrid Hen and Jungle Cock.* On page 25 (*Spolia Zeylanica*, vol. IV.) it was stated that "At Hunasgiriya Mr. Johnson put a hybrid pullet to his famous jungle cock (daughter to father), but as there were domestic hens in the run no attention was paid to this hybrid; and her eggs were naturally infertile."

Mr. Johnson writes that for a whole twelve month the jungle cock was faithful to one single domestic hen and neglected all the other domestic hens in the same run, but that as soon as he placed two of his hybrid pullets into this run the cock became on intimate terms with them both, as well as with his favourite domestic, and trod all three freely, thus clearly proving that the jungle cock is not always monogamous even in captivity.

Further, Mr. Johnson states that in the first batch of eggs which one of these hybrid pullets laid after running with the jungle cock, there were two which proved to be fertile though no chickens were hatched out. This is a clear indication that the hybrid hens are not sterile when mated back to the jungle parent, and gives hope of successfully producing chickens when this experiment shall be tried again.

Another omission was with regard to experiment *No.* 3, *Hybrid Cock and Hybrid Hen* (p. 25). It should have been mentioned that in March, 1906, in the Queensdown run, one egg of a batch laid by the hybrid hen was broken by mistake during the period

of incubation, and was found to contain a three-quarter developed living chicken, too immature to live. It was shown to Dr. Willey, F.R.S., of the Colombo Museum. All the other eggs of the clutch proved infertile. Had this egg not been broken, there seems no reason why it should not have hatched out at full term. This incident gave fresh hope and zest to further experimenting.

Since 1st June, 1906, this last experiment has met with some important success. Two wild jungle hens were introduced into the run with the hybrid cock and hybrid hen. This seemed to draw the hybrids closer together, and they both treated the wild hens so badly that after a time they had to be removed to save their lives. This entirely bore out the opinion expressed on pages 25 and 26 as to the selection of various females by the hybrid cock, *i.e.*, that if he had a hybrid hen and a jungle hen, he would certainly by preference take up with the hybrid and neglect the jungle hen.

It was certainly after this experiment that the first success with the hybrids was achieved.

A batch of seven eggs laid by this hen in August were incubated by herself, and on 3rd September, 1906, the first chicken was hatched out in the Queensdown run from this hybrid + hybrid mating. The six other eggs of the setting were infertile, which seems a very remarkable fact and will be noted later. It was thought well to coop up this chicken with its mother, because at nights the hen roosted on a high perch, and if the chicken remained on the ground it would be certainly eaten by rats. It was no easy matter to catch this one day old chick; the hybrid mother was very fierce and defended her young with great determination. She would fly at the would-be capturer, not at his hands or feet, but would hurl herself, with an impetuosity and abandon that are unknown in domestic birds, right at his face. In fact it was necessary first to capture the mother and then the matter was simplified. The chicken seemed very robust and thrived very well in the coop and feathered rapidly. After eight days of cooping, which was much resented by the hen, they were both turned into the experimental run with the cock. The chicken was of a whitish gray colour, with three dark streaks on the head and down the back. The shanks were yellow. It feathered very rapidly. The wing feathers were of a pale brown with dark barrings, just like the markings of the wing of the hybrid hen and exactly like those of a jungle hen. When startled it darted about with great rapidity, more swiftly than the ordinary domestic chick, and very like the wild jungle chick. It was a good flyer at the age of nine days, flying with ease up on to a perch more than four feet from the ground. At nights it always roosted on a high perch under the mother's wing.

A domestic chick could not do this at such an age. It was fed on broken paddy, canary seed, white ants, and chopped onions. After being in the run a week it began to pine and mope. The mother then seemed to neglect it, and the cock was seem to peck it several times when feeding. It died on 21st September, being eighteen days old.

After this the hybrid hen laid again and laid fifteen eggs. The first nine were removed and set in an incubator; the next six were at first set under the hybrid hen, but she forsook them, and so they were put under a common hen. These eggs were hardly expected to be fertile, as the cock bird for some weeks had been very far from well, suffering from a severe cold. However, one of the eggs in the incubator was addled, and the remaining eight were clear.

Some days later, 24th November, 1906, those (six) set under the hen produced one healthy little chick, the other five eggs being quite clear.

This chicken was exceedingly small in size, resembling that of a black-breasted red game bantam. In colouring it was much darker than the previous chick of the same parentage. It was of a decided brown colour with a broad band of a darker brown on the head and down the back. It feathered rapidly like the previous one, and seemed very well, but a solitary chick with a mother hen has not a good chance of life. On 5th December it died rather suddenly, aged twelve days, the cause being unknown.

The next batch of eight eggs laid were set under a common hen in December, 1906. Seven eggs were quite clear, while the eighth had a full-term dead chick in the shell; the shell had not been "pipped."

Nine eggs were set early in January, 1907, under a common hen, but all these proved clear.

Ten eggs were set later in January in an incubator, but all ten proved clear.

Early in February, 1907, thirteen eggs were set under a common hen. None hatched out. Nine were clear, two were addled, one had an early embryo dead in it, and the remaining egg had a full-term dead chick in the shell; the shell had not been "pipped."

Later, in February, 1907, seven eggs were set. None hatched out. Five were clear, one egg had a dead chick of about thirteen days old in it, and the remaining egg had a dead chick of about sixteen or seventeen days old.

Early in March, 1907, five eggs were placed in an incubator, but all five proved clear, infertile.

In April, 1907, she laid ten more eggs and showed no sign of going broody. The eggs were set. Nine proved clear; one had a full-term dead chick in the shell.

Table showing Settings and Results of the Hybrid + Hybrid Eggs from June 1, 1906, to June 1, 1907.

Settings.			Results.			
How set.	Date.	Number of Eggs.	Infertile.	Addled.	Dead in Shell.	Hatched out.
	1906.					
Incubator ..	June 7	6	6	—	—	—
Hybrid hen ..	June	6	6	—	—	—
Do. ..	Aug. 14	7	6	—	—	One chick (lived 18 days)
Incubator ..	Oct. 27	9	8	1	—	—
Common hen ..	Nov. 3	6	5	—	—	One chick (lived 12 days)
Do. ..	Dec. 17	8	7	—	One full-term	—
	1907.					
..	Jan. 5	9	9	—	—	—
Incubator ..	Jan. 25	10	10	—	—	—
Common hen ..	Feb. 9	13	9	2 and 1 embryo	One full-term Two nearly full	—
Incubator ..	Feb. 19	7	5	—	—	—
Do. ..	March 5	5	5	—	—	—
Common hen ..	April 13	10	9	—	One full-term	—

Some observations on the results obtained from this pair of hybrids (brother and sister) may not be out of place.

(1) The first thing that strikes one is *the large number of eggs laid* by this one hen. Since 1st June, 1906, up to date, 1st June, 1907, she has laid no less than 100 eggs, a very good average for an ordinary hen. Her mother, a common mongrel domestic, probably never laid more than sixty or seventy per annum. At first the eggs were never removed from the nest and then she laid usually six or seven eggs. A noticeable feature was the wonderful way in which she fouled her eggs. When they were not removed they all became exceedingly dirty. Later the eggs were dated as laid, and each day an egg was removed, always leaving the last laid one in the nest. It was only since this was done that she laid so well and failed to become broody, and the cleanliness of the eggs was secured.

(2) Another interesting point is that this hen so *seldom becomes broody*. From 1st June, 1906, up to date, 1st June, 1907, she was only broody three times ; twice she sat the full time, and on the third occasion forsook her nest after about one week.

(3) *The low percentage of fertile eggs* in each batch is very striking. Usually there is only one fertile egg in a batch. This is very remarkable. In the case of turkeys, after the cock treads the hen the whole batch of her eggs are fertile, although the cock is removed and treads the hen no more. The fertilization is sufficient for all the eggs. And it is generally supposed that one treading of a hen by a rooster is sufficient to fertilize several eggs. This is apparently not the case with the hybrids. It may be noted that no one has ever yet observed this hybrid cock tread this hybrid hen. Furthermore when more than one egg in a batch has been fertilized, it has been noticed that it is not consecutive eggs that are fertile ; the fertile eggs are at irregular intervals. What conclusion is to be drawn ? That the cock only fertilizes one egg for one treading ? And that he only treads the hen at irregular intervals, and not daily ? Or, that if he does so daily only a few odd eggs are really fertilized ? Is it a lack of fertility in the male ?

(4) *The low percentage of fertile eggs to hatch out.*—Only two chickens have been hatched out. Only three quite full-term chicks have been found dead in the shell. Only two near full-term chicks dead have been found in the eggs. Several eggs have been addled ; and one only had a quite young dead embryo.

(5) *The low percentage of viability of the chicks when hatched.*—Only two chickens, and they died after eighteen and twelve days respectively. They seem sturdy and robust enough when hatched, but go off in the second or third week. Deductions cannot of course

be drawn from such a small number as two, but the fact remains that they have not lived for even three weeks. Every poultry fancier, however, knows that it is a much harder thing to rear a single solitary chick than a brood of them.

From the foregoing it is obvious that, while the sterility of these hybrids cannot be upheld, yet there is nevertheless a certain amount of "relative sterility."

Whilst fully bearing in mind that these conclusions are only drawn from the doings of a single pair of hybrids, brother and sister, it must be stated that the other pair, or rather a cock and two hens, of hybrids in Mr. Bliss's Atagalla run, have not yet produced even a single fertile egg since they were mated up. In fact the foregoing is the only success the experimenters can boast of at present.

To summarize. The experiments have shown that—

(1) The hybrids are not sterile when bred *inter se*.

(2) The hybrids are not sterile when bred back to the domestic parent (*i.e.*, hybrid cock with domestic hen).

(3) There is some indication that the hybrids are not sterile when mated back to the jungle parent (*i.e.*, jungle cock and hybrid hen).

The sterility of these hybrids therefore cannot now be adduced as it was by Darwin, as one of the proofs that the *Gallus Stanleyi* is not a parent stock.

To give the summary in greater detail the results of the mating are thus:—

Jungle cock and domestic hen.—Thirty chickens produced.

Jungle hen and domestic cock.—No eggs laid.*

Hybrid cock and domestic hen.—Many chickens produced.†

Hybrid cock and jungle hen.—No eggs laid.*

Hybrid hen and domestic cock.—No eggs fertile yet.

Hybrid hen and jungle cock.—Two addled eggs only.

Hybrid cock and hybrid hen.—Several addled eggs. One live immature chick in broken egg; five full or nearly full-term chicks dead in shell; two chickens hatched out (living only eighteen and twelve days).

The experiments so far have been relatively very few; some have not really been tried sufficiently long, and it may be added that many have been tried under very unfavourable circumstances.

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* Has not been given a fair trial. It is believed that jungle hens will never breed in captivity.

† The progeny of this mating are fertile (*a*) with the domestic parent, (*b*) with the hybrid parent, (*c*) with one another.

especially in the matter of really suitable runs. Therefore very decided conclusions cannot be freely drawn. Nevertheless the results obtained give every indication that the complete fertility of the hybrids could be demonstrated if really favourable circumstances obtained.

It would appear that, even if full proof of the complete fertility of the hybrids were forthcoming, it would not necessarily prove that the *Gallus Stanleyi* and the domestic fowl are of one and the same species.

The question naturally arises, how then can the point be demonstrated ? It is suggested that it would be proved if domestic fowls, turned out into the Ceylon jungles, reverted to the *Gallus Stanleyi* type in respect of voice and orange-centered comb in the male. This experiment is obviously out of the question. There is little doubt that under such circumstances these fowls would really mate up with the jungle birds, and the progeny in course of time would become like the wild bird.

Bearing on this subject is the following extract from a letter written in 1905 by Sir William Twynam, K.C.M.G. He says : " There used to be two jungle shrines, one near the old post-holders' house at Rajakadaluwa, near Chilaw, and one in the jungle, a mile distance from the old resthouse at Gal-oya on the Trincomalee road. Offerings of domestic cocks and hens used to be made at these shrines. Being offerings to the gods the natives never touched them, and they mixed with the jungle cocks and hens, with the result that, at Gal-oya in particular, there were round the shrine the most beautiful creatures I ever saw in the shape of poultry. The cocks were simply gorgeous in their plumage. They seemed to be a little larger than the ordinary jungle cocks."

The Assistant Government Agent of this district, Mr. W. L. Kindersley, made inquiries on the subject and wrote : " I have not been able to hear of any such fowls. It is said that if the eggs of the jungle fowl are hatched under a tame hen, the birds on arriving at maturity always make for the jungle ; and in cases where domestic hens have been trodden by jungle cocks, the young birds also make for the jungle when adult."

The " reversion " proof has not been applied to demonstrate the claim of the *Gullus bankiva* to be a parent stock, and yet its claim is freely admitted. An important point bearing on this question is the fact that when domestic birds do revert, the reversion in the matter of the colour of the breast of the males is always to a red or brown, and never to black. Even domestic black-breasted reds tend to revert to red or brown. In this particular then the reversion is not to the *Gallus bankiva*, which is black breasted, but to the *Gallus Stanleyi*, which has a reddish brown breast.

The subject of the variation of the Ceylon Jungle Fowl needs investigation. The distribution of this bird is so circumscribed that there is but little scope for variation. The *Gallus bankiva*, on the other hand, ranges from Cape Comorin to the Himalayas, from far western India to Burma, across Siam to the Straits; it is not surprising therefore that it varies considerably in size and colouring according to variations in soil and climate. The *Gallus Stanleyi* has little opportunity for such marked variation. There is, however, some difference between the birds of the north and of the south. In the latter region the hens are very much darker than in the north; and the cocks up north are of a more brilliant and lighter red. But all this is mere deviation in tint and not a marked mutation, such as would be a cock with a black breast. It would appear that *Gallus Stanleyi* practically never mutates from the standard pattern, and apparently but very rarely sports.

In this connection the following extracts from letters which I have received from Mr. Walter Price, dated Kandy, June 19 and 21, are of interest :—

"It may interest you to learn that there is or was until lately a white jungle fowl hen to be seen in company with other ordinary jungle fowl at a place on the Anuradhapura-Puttalam road, about 14 miles from Anuradhapura.* When I saw it first I mistook it for a paddy bird and it would have escaped identification as a jungle fowl if it had not been in the company of another pair. I got quite close to it and saw that it was undoubtedly a jungle hen, almost pure white except for a few gray feathers on the neck and head. Mr. Vigors, the Government Agent, saw the same bird shortly afterwards at the same place. At the time I saw this bird I was not aware that such a variation in colour was so uncommon, or I might have made an exception to my general principle of sparing curiosities. Both Mr. Vigors and I thought it would be better to leave it where it was to see if it would have any effect on the colour of the other birds about that locality. Down in the south of Sabaragamuwa and in Hambantota there is an inclination for the birds to be brown, especially the hens, which are very dark, in many cases with black spots on tail and wings. The tendency in the open scrub country of the Northern Province and in Tamankaduwa, in the North-Central Province, is for the birds to be red in colour; the cocks of course always have a lot of red about them, but it is more brilliant and lighter up north, and exactly to the same extent is the hen light in colour. I suppose it is the same influence which makes the wandaroo monkey almost black down south, while he is almost white up north."

* Between Sinharagama and Kala-oya.

ON THE HYDROPHIDÆ IN THE COLOMBO MUSEUM.

By Major F. Wall, I.M.S., C.M.Z.S.

DURING a recent brief visit to Ceylon, through the courtesy of the Acting Superintendent of the Colombo Museum, I had the privilege of examining the collection of snakes preserved in that institution. I paid particular attention to the sea snakes, and propose to make some remarks on the specimens of this family I saw there.

The collection poorly represents the species available, comprising as it does but ten species and only thirty-five specimens. It is remarkable among other things that a snake so common as *Enhydrina valakadyen* is around the coast of India should be represented by a solitary small specimen. I have had these brought to me in India (Cannanore) in bucketfuls. I have picked out as many as a dozen from a single net on the Coromandel Coast (Gopalpore).

In reference to the scales, "anterior" implies at a point two heads' lengths behind the head, and "posterior" two heads' lengths in front of the vent.

Hydrus platurus (Linnæus).

There are seven specimens. Three of these, one adult (No. 363), and two young (No. 153, and one unnumbered) are black dorsally, brown ventrally, with a yellow costal line separating these two hues. These correspond to Boulenger's variety D. (Cat. Snakes, British Museum, vol. III., p. 268). A fourth specimen (No. 153) differs from the typical variety D in the absence of the yellow costal line, and constitutes a rare form of which I have only seen one other example. In two specimens the upper parts are black, the lower yellow, and these correspond to Boulenger's variety E (*loc. cit.*), the *Hydrus bicolor* (Schneid.). One example (No. 108) is too faded to distinguish the variety.

Hydrophis spiralis (Shaw).

Represented by three specimens which I allude to as A, B, and C. All agree in the following particulars. *Præfrontals* touch the second labial. *Postocular :* one. *Labials :* third and fourth touch

the eye. *Sublinguals :* two pairs, the posterior in contact. *Infralabials :* fourth largest, and touching three scales posteriorly. Suture between the first smaller than that between the anterior sublinguals. *Scales :* imbricate in whole-body length. *Ventrals :* distinct throughout, or a few divided here and there.

Irregularities.—In A the single anterior temporal does not reach the labial margin, and is followed by another equally large shield. Three small *marginals* border the lower lip behind the third infralabial. Forty-three complete black rings encircle the body. These are rather dilated vertebrally, and a few intermediate dorsal spots occur, which are indistinct.

In B, the single anterior temporal does not reach the labial margin, and it is followed by two smaller scales along the parietals. Three marginals succeed the third infralabial on the left side, and three the second infralabial on the right side. It has thirty-nine narrow rings slightly dilated vertebrally and ventrally, and a regular series of distinct intermediate dorsal black spots.

Example C has the single anterior temporal coming down to the labial border, and this is followed by another equally large shield. Only one wedge-shaped marginal occurs between the third and fourth infralabials. It is singularly handsomely adorned with thirty-seven very black rings, some slightly interrupted costally. These are dilated vertebrally and ventrally, and there are regular series of large black dorsal and ventral intermediate spots. I have never met with another similarly marked, and I notice Boulenger (*loc. cit.*, p. 274) makes no mention of ventral spots.

	Scales.			
	Anterior.	Mid-body.	Posterior.	Ventrals.	Museum No.	
A	28	33	32	339	113	Small adult
B	27	33	35	294	113	Adolescent
C	26	30	27	306	113	Small adult

A is probably the specimen referred to by Ferguson (Reptile Faun. Ceylon, 1877, No. 110), and Haly (Catalogues 1886, No. 57 ; and 1891, No. 113).

Hydrophis gracilis (Shaw).

There are four fine examples. These agree in the following ways. *Rostral :* portion visible above equals, or nearly equals, the suture between the nasals. *Præfrontals* touch the second labial. *Postocular :* one. *Anterior temporals :* one, followed by another equally large or larger shield. *Labials :* six, the third and fourth touching the eye. *Sublinguals :* two pairs, the posterior

in contact. *Infralabials :* the fourth is the largest of the series and touches two scales behind. The suture between the first is longer than that between the anterior sublinguals. *Marginals :* none occur between the first five infralabials. *Scales :* imbricate anteriorly, juxtaposed behind. *Ventrals :* divided posteriorly. They are all typical in colour and markings.

Irregularities.

	Scales.				
	Anterior.	Mid-body.	Posterior.	Ventrals.	Museum No.
A	19 ..	29 ..	31 ..	255 ..	119 .. Adult
B	17 ..	29 ..	30 ..	219 ..	119 .. do.
C	19 ..	31 ..	33 ..	237 ..	119 .. do.
D	18 ..	30 ..	32 ..	217 ..	121 .. do.

A is erroneously labelled *H. fasciatus.*

Distira Stokesi (Gray).

Two examples are preserved in spirits. One is the large adult presented by Captain Donnan from the pearl fishery, and referred to by Ferguson (Reptile Faun. Ceylon, 1877, No. 106 1) and Haly (Catalogues, 1886, No. 56 ; and 1891, No. 122). It is a very heavy creature, remarkable as a sea snake for the girth of its head and neck. The girth behind the neck I measured $7\frac{1}{2}$ inches and in mid-body 9 inches. It is over 5 feet in length. The small specimen is that presented by Master J. Robertson, referred to by Haly (Catalogues, 1886, No. 56 ; and 1891, No. 122).

They agree as follows :—*Rostral :* portion visible above half to two-thirds the suture between the nasals. *Præfrontals* touch the second labial. *Postoculars :* two. *Anterior temporals :* two or three, followed by two other large shields in contact with the parietals. *Labials :* nine to eleven ; the fourth, fifth, and sixth touching the eye. *Sublinguals :* absent. *Scales :* strongly imbricate and with subdentate borders. *Ventrals :* a few are present in the neck ; except for these, they are replaced by a pair of imbricate scales similar to the adjacent costals.

A, large adult.—Scales are 44, 54, and 50 in the anterior, mid, and posterior parts of the body. B, half grown.—Scales 42, 52, and 44 in the same parts of the body as preceding ; both are labelled No. 122. The supraoculars are partially divided transversely in both specimens.

Distira ornata (Gray).

There are four specimens, which agree in the following :—*Rostral :* portion seen above about half the length of the suture between the nasals. *Præfrontals* touch the second labial, except

on the right side in specimens B and D, where they fail to do so. *Postoculars :* two. *Anterior temporals :* one, succeeded by another subequal shield. *Sublinguals :* two pairs, the posterior separated by two small scales. *Infralabials :* the fifth is the largest of the series and touches three or four scales behind ; suture between first longer than that between the anterior sublinguals. *Marginals :* none occur between the first five infralabials. *Ventrals :* distinct throughout, a few here and there divided.

Irregularities.—A specimen has eight labials on the right side and seven on the left. The third, fourth, and fifth touch the eye. The scales are juxtaposed posteriorly. Fifty-one broad black bars ornament the dorsum, below which, and alternating with them, is a series of vertical costal spots.

B has eight labials on the left side and seven on the right ; the third, fourth, and fifth touch the eye on the left side, the third and fourth only on the right. The scales posteriorly are subimbricate. Forty-five bars dorsally.

C has seven labials on the right side, eight on the left ; the third and fourth touch the eye on the right side, the third, fourth, and fifth on the left side. The scales are subimbricate ventrally behind, juxtaposed dorsally. There are forty-one bars dorsally.

D has seven labials, with the third and fourth touching the eye on both sides. The scales are juxtaposed posteriorly, and there are forty-one dorsal bars. The posterior sublinguals are so small that they do not deserve the name.

A, B, and C are evidently the specimens referred to by Haly (Catalogue, 1891, No. 127).

	Scales.			
Anterior.	Mid-body.	Posterior.	Ventrals.	Museum No.
A 36 ..	43 ..	36 ..	290 ..	127 .. Adult
B 35 ..	42 ..	38 ..	270 ..	127 .. do.
C 36 ..	43 ..	41 ..	269 ..	127 .. Young
D 35 ..	44 ..	40 ..	(?) ..	(?) .. Adult

Distira Brugmansi (Boie) = *D. robusta* (Günther).

Represented by five specimens, which agree in the following respects :—*Rostral :* visible portion above half to two-thirds the suture between the nasals. *Præfrontals* touch the second labial. *Anterior temporal :* one. *Labials :* seven, the third and fourth touching the eye. *Sublinguals :* two pairs, the posterior in contact. *Infralabials :* the fourth is the largest of the series, and in contact with three scales behind. *Scales :* imbricate in whole body. *Ventrals :* distinct throughout ; a few here and there divided.

Irregularities in Distira Brugmansi.

	Scales.			Ventrals.	Postoculars.	Temporal touches Labial Margin.	Marginals.	Museum No.	
	Anterior.	Mid-body.	Posterior.						
A	29	36	32	339	1	Right side	2 after third infralabial	113	Adult
B	27	33	33	333	2	No	3 on right side ; 2 left side	124 (?)	do.
C	26	31	32	330	1	Left side	3 on right side ; 2 left side	(?)	Small adult
D	27	31	31	315	1	do.	All after third infralabial	113	Adolescent
E	27	33	31	319	2	do.	2 after third infralabial	124	Adult

D has three præfrontals in one transverse row.

A has narrow rings dilated vertebrally, and some interrupted costally, especially in front, where they are modified to dorsal bars.

B has forty-nine narrow complete rings not dilated vertebrally.

C has forty-two complete rings, dilated but not confluent ventrally.

D has forty-four complete rings, slightly dilated vertebrally, more so ventrally.

E has forty-four complete rings dilated vertebrally and ventrally, and more or less joined by a narrow ventral line.

B and E are evidently those referred to by Haly (Catalogue, 1891, No. 124).

Distira cyanocincta (Daudin).

There are four specimens, which agree as follows :—*Rostral :* portion visible above two-thirds to equal in length to the suture between the nasals. *Præfrontals* touch the second labial. *Postoculars :* two (except in A specimen on the right side, where there is one only). *Anterior temporals :* two, followed by two small scales along the parietals. *Labials :* seven or eight, the third, fourth, and fifth touching the eye. *Sublinguals :* two pairs, the posterior in contact. *Infralabials:* the fourth is the largest of the series and touches three scales behind. Suture between the first smaller than that between the anterior sublinguals. *Marginals :* a complete series succeeds the second infralabial. *Scales :* imbricate throughout. *Ventrals :* distinct throughout, or a few divided here and there.

Irregularities.

	Scales.				
	Anterior.	Mid-body.	Posterior.	Ventrals.	Museum No.	
A	31	37	38	324	118	Young
B	30	35	37	313	125 (?)	Half-grown
C	31	33	35	320	125	do.
D	32	39	39	338	125	Adult

A has forty-five complete rings expanded vertebrally and constitutes Boulenger's variety B (*loc. cit.*, p. 295). It is evidently the specimen referred to by Haly in his Catalogue (1891, No. 118), since it still bears the label *Hydrophis fasciatus* and the No. 118.

B has fifty-two rings, much expanded vertebrally, and is also one of Boulenger's variety B. It is very rough, the head shields are mammillated, and many of the body scales have bidentate or tridentate tubercles, or keels.

C has fifty-one rings, much dilated vertebrally and confluent ventrally, corresponding to Boulenger's variety A (*loc. cit.*).

D has forty-four rings, dilated vertebrally and more or less confluent ventrally, and is also one of Boulenger's variety A.

Distira Jerdoni (Gray).

Represented by two examples, one adult, one young, both labelled No. 123. They are typical. In the larger specimen the scales are seventeen behind the neck, nineteen in mid and posterior body, and the ventrals are 232. Referred to by Haly (Catalogues, 1886, No. 55; and 1891, No. 123).

Enhydris curtus (Shaw).

Three specimens are preserved, which agree in the following characters:—*Rostral:* portion visible above about one-third the length of the suture between the nasals. *Præfrontals* touch the second labial, except in specimen B, where they meet no labial. *Postoculars:* one. *Labials:* seven or eight, the third and fourth touching the eye, except in specimen B, where only the fourth does so. *Infralabials:* the fourth is the largest of the series, and touches four scales behind. *Sublinguals:* too ill-developed to be considered as such. *Scales:* juxtaposed throughout. *Ventrals:* entire throughout.

In A specimen the parietal is divided on the left side, but only partially so on the right. One marginal is wedged between the third and fourth infralabials.

In B the parietals are broken up into five parts each. There are two marginals after the second infralabial.

In C the parietals are quite broken up. A row of marginals succeeds the second infralabial.

	Scales.				
	Anterior.	Mid-body.	Posterior.	Ventrals.	Museum No.
A	29 ..	34 ..	31 ..	156 ..	106(?).. Adult
B	36 ..	41 ..	40 ..	195 ..	106 .. do.
C	30 ..	35 ..	30 ..	158 ..	106 .. do.

Enhydrina Valakadyen (Boie).

Represented by a solitary, small, faded specimen, labelled No. 119. I cannot trace the other specimens in the collection referred to by Haly and Ferguson in their Catalogues, and it is to be noted that the *Hydrophis cantoris* mentioned by Haly (Catalogue, 1891, No. 120) could not be identified.

DESCRIPTION OF A NEW LIZARD OF THE GENUS LYGOSOMA FROM CEYLON.

By G. A. Boulenger, F.R.S.

Lygosoma punctatolineatum.

SIMILAR in general appearance to *L. taprobanense*, and likewise with a rather small ear-opening, a scaly lower eyelid, no supranasals, the frontal shield narrower than the supraocular region, and short, pentadactyle limbs; but easily distinguished by the very small size of the præfrontal shields, which are widely separated from each other, the suture between the frontonasal and the frontal being as extensive as that between the former shield and the rostral. Upper head shields otherwise as in *L. taprobanense*. Third, fourth, and fifth upper labials below the eye. No projecting lobules on the anterior border of the eye. Twenty-six smooth equal scales round the body. Prænasal not enlarged. Ten to twelve lamellæ under the fourth toe. Bronzy brown above, with series of small black spots corresponding to the dorsal scales; a black lateral stripe, from the eye to the root of the tail; belly yellowish in the middle, grayish on the sides.

From snout to vent 43 millim.; from snout to fore limb 16; fore limb 10; hind limb 12; tail (reproduced) 48.

Two specimens, adult and young, from Hakgala, 5,000 feet.

NOTES.

1. *Occurrence of the Indian Snake Lycodon striatus in Ceylon.*—The first authentic record of *Lycodon striatus* occurring in Ceylon is by E. E. Green (*Spolia Zeylanica*, vol. II., March, 1905, p. 205).

While recently in Ceylon Mr. E. E. Green presented me with five specimens which he believed to be of this species. I have examined these, and agree with him as to their identity, and I am much indebted to him for the privilege of being able to see them, and make the following remarks.

All the specimens are adult and were obtained in Peradeniya. I find them typical of the Indian variety in shield and scale characters, but they differ somewhat in colour. Thus the following characters demand special mention: (1) the snout is not spatulate; (2) the loreal is single and touches the internasal; (3) the præocular does not meet the frontal; (4) the nasal touches the first and second supralabials (except on one side in one specimen, where only the first supralabial is in contact); (5) the supralabials are eight, and the third, fourth, and fifth touch the eye; (6) the ventrals are not angulate; (7) the anal is divided, except in one specimen; (8) the scales are seventeen at a point two heads' length behind the head, seventeen in mid-body, and fifteen at a point two heads' length before the vent, and all are smooth.

The occipito-nuchal and dorsal bars are brown or buff and are thus far more indistinct than in the Indian form, where I have always found them pure white and well defined.

The ventrals and subcaudals are as follows: (1) 150 + 39 (anal entire); (2) 155 + 35; (3) 158 + ? (tail docked); (4) 164 + ? (tail docked); (5) 159 + 34 (tail slightly docked).

F. WALL, C.M.Z.S.,
Major, I.M.S.

Calcutta, February 17, 1907.

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2. *The Common Indian Krait, Bungarus candidus, in Ceylon.*—Whilst going through the collection of snakes preserved in the Colombo Museum I discovered a bottle containing a specimen labelled *Bungarus ceylonicus*, from Polgahawela, presented by Mr. J. Rudd, which I have no doubt is in reality a typical specimen of the Indian Krait, *B. candidus* (variety *cæruleus*).

This is a matter of considerable interest, for hitherto this species, as an inhabitant of Ceylon, rested on the single example obtained by Mr. Rudd at Jaffna. This is referred to by Haly (Catalogue, 1891, No. 102), and later by Willey (*Spolia Zeylanica*, vol. III., 1906, p. 233).

With this single specimen on record it was open to speculation whether the species does really inhabit Ceylon, as more than one instance is known of snakes being transported by ships in cargo or timber to ports remote from the regions they naturally inhabit.

Again, it does not follow that a snake inhabiting the northern part of the Island will be found in other parts of the Island, for the fauna of the northern part agrees with that of the Southern Madras Province to the east of the Western Ghats, whilst that of the rest of the Island conforms to that of the Malabar region (Blanford. Journal of the Asiatic Society of Bengal, vol. XXXIX., pp. 336 to 339).

This second specimen sets at rest any doubts there may have been on the subject, and substantiates Ferguson's opinion (Reptile Faun. of Ceylon, 1877, No. 102) that the Indian Krait is found in Ceylon, the evidence for which statement having been seemingly lost.

In all I examined five specimens of the Indian Krait, three of which have no record of locality, and it may well be that two of these are the specimens referred to by Ferguson (*loc. cit.*) as having been presented by himself.

Polgahawela, situated where it is, leaves little doubt that the snake is to be found throughout Ceylon.

I compared the five Indian specimens with many examples of the Ceylon Krait, *B. ceylonicus*, side by side, and it appears to me that they are to be distinguished as follows: The Ceylon Krait appears to me a distinctly smaller reptile. In colour it is very distinctive. The broad black bands pass beneath the belly, except in very young examples, but even in these I found them more or less apparent beneath the tail when absent on the body. The white bands are most distinct anteriorly, gradually becoming less so posteriorly. They are broader than in *candidus* and single and equi-distant. The second supralabial is decidedly narrower than the third, and the suture made by the præocular with the second supralabial is much smaller, often only half that formed by the præocular and the third supralabial.

Candidus is decidedly larger. The black bands do not pass beneath the belly, which is always pure white even beneath the tail to its tip. The white bars are most distinct behind, and become obscure and lost anteriorly. They are in pairs behind,

but the pairs blend and become lost anteriorly. The second supralabial is about as broad as the third. The sutures made by the præocular with the second and third supralabials are about equal.

The specimen in question accords with the latter characters, and the ventrals and subcaudals are 195 + 43.

F. WALL, C.M.Z.S.,
Major, I.M.S.

Colombo, February 10, 1907.

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3. *Remarkable Snake Fatality.*—Whilst in Nuwara Eliya, on the 4th of February, I discovered a dead snake hanging head downwards from a hole in a bank on the road near the boathouse. A closer examination proved that its body was tightly impacted in the hole, for I was unable to pull it out, though using considerable force. I eventually had to dig the body out, and then identified the snake as *Aspidura trachyprocta*, and discovered that it was a heavily egg-bound female.

Its death was directly due to the increased girth arising from its maternal expectations. The snake was 16 inches in length, and when laid on its side showed a marked constriction at the seat of impaction, some 11 inches from the snout. The constriction measured a quarter of an inch, against a diameter of half an inch immediately before and behind.

On cutting the snake open I found six eggs measuring seven-eighths of an inch each. Two of these had been forcibly dragged through the hole without rupture, but the remaining four were lying behind the constriction, and were much congested in common with the neighbouring tissues and organs.

Remarkable as this incident appears it is not the first of its kind I have met with. In Fyzabad in India I once found a checquered Keelback (*Tropidonotus piscator*) which had similarly underestimated its bodily proportions and had insinuated itself between the crevices of some boards that walled up the supports of a bridge, in such a way that it was unable to release itself, and died from the compression resulting from its own endeavours to advance.

These two accidents seem to me to argue a very poor intelligence, since a retrograde movement in either case would have extricated the victim from its predicament.

F. WALL, C.M.Z.S.,
Major, I.M.S.

Colombo, February 10, 1907.

4. *Three Chinese Coins from Polonnaruwa.*—Intercommunication between the people of Lanka and the Chinese seems to have been maintained over a long space of time. Apart from the accounts given by Fa Hien and Huen Tsiang in the 5th and 7th centuries A.D. of their pilgrimages, and the mention in the *Rajavaliya* of a Chinese invasion of Lanka in the 14th century, there is sufficient evidence of commerce in the "Finds" made by the Archæological Survey. Scraps of porcelain and china, undoubtedly Chinese, have been found at Anuradhapura; and a Chinese bowl, unfortunately broken into fragments, was unearthed at Sigiriya.

The latest addition to our knowledge on this point is the interesting note supplied by Mr. R. F. Johnston of the Hong Kong Civil Service.

The coins described below were excavated by the Archæological Survey near the Thuparama at Polonnaruwa.

March 7, 1907. JOHN STILL.

Note referred to.

咸平 1. "Hsien P'ing."—First Reign Title of the Emperor Chên Tsung, 眞宗, who reigned 998 to 1022 A.D. The words "Hsien P'ing" denote that the coin belonged to the years between 998 and 1004 A.D. The Emperor in question was the Third Sovereign of the Sung dynasty, 宋紀

元豐 2. "Yüan Fêng."—Second Reign Title of the Emperor Shên Tsung, 神宗, who reigned from 1068 to 1085 A.D. The words "Yüan Fêng" show that the coin belongs to the period between 1078 and 1085. This Emperor was the Seventh Sovereign of the Sung dynasty, 宋紀

崇寧 3. "Ch'ung Ning."—Third Reign Title of the Emperor Hui Tsung, 徽宗, who reigned from 1101 to 1125 A.D. The words "Ch'ung Ning" show that the coin belongs to the period between 1102 and 1107. This Emperor was the Ninth Sovereign of the Sung dynasty, 宋紀

All these coins belong to the same dynasty (the Sung). They cover a period of not more than 109 years, or not less than 98 years. The date of each is fixed within a very few years. The old Chinese custom of changing the Reign Title sometimes several times during the same reign is often confusing, but it is of assistance in fixing a date when the precise cyclical year is not mentioned. The sovereigns of the present Chinese dynasty do not adopt more than one Reign Title for each reign, *e.g.*, "Kwang Hsü," 光緒帝, is the Reign Title—not the personal name—of the present Emperor, and has been so throughout his reign.

Weihaiwei,
October 28, 1906.

R. F. JOHNSTON.

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5. *Elephants in Ceylon.*—It is well known that in Ceylon there are two breeds of elephants, the one with tusks and the other with tushes. Possibly these extracts from the *Mahawansa* may throw some light on this rather curious fact: "And he (the King of Ramañña) also made a decree that the elephants that many persons had sold in his Kingdom for export should not any longer be sold."—Chapter 76, verse 17.

"And he likewise put an end to the ancient custom of giving an elephant to every ship that bore presents to the King (of Lanka)."—Chapter 76, verse 20.

"On another occasion he took the presents and the merchandise from the messengers whom the Lord of Lanka had sent in charge thereof that they might buy elephants, saying 'fourteen elephants shall we give you or their value in money.' But he spake only a lie and gave nothing to them."—Chapter 76, verse 33.

"And the people of Ramañña sent yearly many elephants, and entered again into a covenant with the Lord of Lanka."—Chapter 76, verse 75.

Ramañña was in Lower Burma, where, I believe, the elephants are tusked.

JOHN STILL.

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6. *Do Butterflies migrate by Night?*—Any one who has watched one of the periodical migration flights of butterflies in Ceylon will have noticed how the numbers of individuals increase directly with the sun's altitude, so that the idea of a nocturnal migration seems at first sight very improbable. The following facts, however, have led me to suppose that some butterflies do migrate by night, at least occasionally, if not as a general rule.

(1) In the beginning of January, 1907, when we were lying in Colombo harbour, several specimens of *Tros* (*Papilio*) *hector*, L., flew off to the ship one night.

(2) On the evening of 17th January, 1907, we were anchored off Beruwala, quite a mile from the nearest land. About 9 P.M. a few individuals of *Tros* (*Papilio*) *hector*, L., suddenly came on board and were accompanied by numbers of *Parnara cingala*, Moore. It was a cloudy, sultry night, with a little rain ; there was no wind at the time, but later on a slight southerly breeze got up.

The numbers of the butterflies—the *P. cingala* must have been in scores—combined with the distance from land prohibit the idea of any mere chance. Their flight must have had some definite object, and that, I believe, was migration. However, the evidence is slender, and this note is merely intended to call attention to the facts and to elicit corroboration.

The only previous records of such nocturnal migration to which I find references, are in the cases of *Eugonia j-album* and *Anosia archippus*, as related by Scudder,* so that any evidence appears noteworthy.

T. BAINBRIGGE FLETCHER.

H. M. S. *Sealark*,
February 15, 1907.

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7. *Significance of the Stridulation in Manduca.*—On 28th June, 1906, I found a specimen of *Manduca* (*Acherontia*) *styx*, Westw. (the Asiatic Death's-head moth), on a tree on Little Sober Island, Trincomalee. It was not on the trunk, but clinging to a slender twig, two or three inches away from the trunk, and about seven feet from the ground. This moth readily flew when disturbed, although the sun was shining very strongly (5 P.M.). It stridulated loudly when touched and when on the wing, and most of all when being seized in the net.†

A few days before I had netted a small leaf-nosed bat at dusk and had noticed that it squeaked loudly when caught. This sound was exceedingly similar to that of the *Manduca*, and I suggest that the cry of the latter mimics the squeak of a small bat. Bearing in mind the comparatively large and needle-sharp teeth of such a bat, I can quite imagine that this cry in the moth would have a pseudaposematic effect on an enemy, and on further irritation the effect is

* Quoted by Tutt, "Migration and Dispersal of Insects," page 46.

† A detailed account of the cry of the imago of the Death's-head moth will be found in the fourth volume of J. W. Tutt's "British Lepidoptera," 1904, p. 444. A figure of the vocal mechanism by Moseley is quoted from "Nature," vol. VI., pp. 151–153.

intensified by the accompanying slight opening of the wings, throwing back of the antennæ, and arching of the abdomen so as to exhibit the false-warning pattern of yellow and black on its dorsal aspect. I might observe that the sizes of *M. styx* and the Leaf-nosed bat, when hanging on a twig with wings closed, are approximately equal.

During the last two years I have met with all three *Manducæ* (*M. lachesis*, F., in the Chagos Islands ; *M. atropos*, L., in the Seychelles ; and *M. styx*, Westw., in Ceylon), and have found the cry of the imago similar in all the species.

It is, of course, possible that the stridulation has also a sexual significance.

T. BAINBRIGGE FLETCHER.

H. M. S. *Sealark*,
February 15, 1907.

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8. *Erythrina indica and the Crow.*—This tree (Sin. Erabodu) just now in blossom, has, in the flowering stage, a strange attraction for crows, which may be seen cawing and hopping about its branches, generally in the early morning. The cause for this, as any one who is curious will discover, is that the flower contains a copious supply of honey-dew in the depression at the junction of the stamen bundle and the carina, and it is this nectar that the birds are after and can be observed quaffing with avidity. One would hardly give the carrion crow credit for such refined taste.

March 8, 1907. C. DRIEBERG.

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9. *Notes by the Way :* Observations during a tour to Trincomalee viâ Matale, Nalanda, Dambulla, &c.*—Matale, October 30, 1906 : My companion drew my attention to a moth (*Syntomis georgina*) sitting on the resthouse wall. A mosquito (*Culex vishnui*) was perched upon its back, with its proboscis inserted in the thorax of the moth, and its abdomen distended with pale greenish blood—evidently the blood of its victim. They were imprisoned in a small glass-topped box for further observation. On the next day the moth was found to be dead, but the Culex was still lively and was provided with a fresh Syntomis. Two days later the mosquito died, without having injured the second moth. I regret now that I did not give the Culex any opportunity of laying its eggs. It is still an open question whether the

* [The first series will be found in *Spolia Zeylanica*, vol. II., p. 194 ; the second series in vol. III., p. 219.—Ed.]

blood of warm-blooded animals is necessary for the successful propagation of blood-sucking mosquitoes. If a meal of insect blood should prove to be sufficient for the nourishment of the developing ova, the occurrence of mosquitoes in tracts of country destitute of the higher animals can be readily accounted for.

Nalanda: This locality is reputed to be rich in butterflies, but a day's collecting here was very disappointing. Species were few in number and the individuals badly worn. *Euplœa asela* was in flight. Small groups of them were settling on the surface of the high road, not apparently on damp spots, but here, there, and anywhere. *Catopsilia crocale* was assembling in large groups, on damp spots in the ditches, especially in the neighbourhood of native houses where dirty water and slops had been deposited. They were also assembled in great numbers on damp sand in a fallow paddy field. Amongst them were a few individuals of *Ixias pirenassa*.

Plants of *Strychnos nuxvomica* (both here and at Habarane) were being defoliated by sphingid larvæ which proved to be those of *Macroglossa affictitia*.

The larvæ of the common Noctuid moth *Amyna selenampha* were abundant on croton and other shrubs.

A small snake was noticed, half submerged in a pool. Holding my stick near its head provoked an instantaneous attack, which made me feel sure that it must be *Tropidonotus piscator* (*asperrimus*)—a particularly aggressive species. On lifting it out of the water my surmise was found to be correct.

Termites' nests in this locality were frequently covered with masses of a small Agaric (subsequently determined by the Government Mycologist as *Entoloma microcarpum*) which was esteemed by the natives as an article of diet—made up into curry.

Anopheline larvæ were noticed in the pools, but the resthouse was just then remarkably free from mosquitoes. Fever was said to have been prevalent in the neighbourhood during the previous month (September), but October was considered a healthy month.

A species of whip-scorpion, *Thelyphonus* (*? sepiaris*), was common beneath stones and logs of wood. My companion found a large specimen in his bed on retiring for the night. This individual was kept alive for several weeks and fed freely upon cockroaches and various other insects. It also completely consumed a small gecko that was imprisoned with it. When annoyed or excited it ejects a volatile fluid smelling like strong acetic acid.

Habarane, November 1: Quite the most interesting capture here was a pair of Attid spiders. One was found under a stone, the other below a tuft of grass. They are of opposite sexes, but whether of different species or not is uncertain. At first sight they were mistaken for Mutillid wasps, of which they are most remarkable mimics. The two sexes mimic two distinct species

of *Mutilla*. In both the thorax is of the dull red so common in the genus *Mutilla*, but the abdomen of the male has two median white spots on a black ground, while that of the female is black, partially banded with golden yellow. Neither Mr. O. Wickwar nor Colonel Bingham, to whom coloured drawings of the spiders were submitted, have been able to match them accurately with any known species of Indian Mutillids. The latter writes: "I believe myself the resemblance is general, *i.e.*, that the spiders are Mutilloid and do not mimic any precise form of Mutilla. I do not think there is in such cases any real necessity for an exact model." Colonel Yerbury also considers "that the resemblance is general and not special."

There was an agreeable absence of mosquitoes at this resthouse also.

During the journey from Nalanda to Habarane the coach was invaded by Tabanid flies (*Hæmatopota*, sp.) which bit and worried the horses. One of them bit me on the wrist, causing very sharp pain at the moment. The bite has resulted in a hard red lump.

Trincomalee, November 3: The butterflies here also are disappointing. Everything is very worn owing to recent high winds. *Papilio hector* is the commonest species and is extraordinarily abundant. There are always some half dozen in sight at any moment. I found eggs and larvæ—presumably of this species—on a plant of *Aristolochia elegans* in one of the gardens. A stroll on the jungle-covered ridge above the Admiralty buildings produced only the following species: *Ornithoptera darsius*, *Papilio hector*, *Rathinda amor*, *Catochrysops Strabo*, *Aphnœus schistacea*, and *Mycalesis patnia*.

November 4: Spent the night on Sober Island and worked the moth trap in a glade in the jungle. A heavy shower of rain fell just before dark. An early moon interfered with the work. A fair number of moths was captured, including an undetermined species of *Gargetta* and a Limacodid new to me. Pterophorids were rather plentiful, and my companion (Mr. T. B. Fletcher, who is specializing in this group) added several species to his collection.

There is a colony of flying foxes on the island.

Oopah estate (near the mouth of the Mahaweli-ganga), November 5: One of the gregarious spiders covers whole bushes with its closely woven webs. It is a species of *Stegodyphus*.* An allied species from Africa has been found to harbour a commensal Tineid in its nests (*vide* Ent. Mo. Mag., 2nd ser., vol. IV., July, 1903, p. 167), and it is quite probable that our Ceylon species

* [Very probably the same species as occurs in the Cinnamon Gardens of Colombo, namely, *Stegodyphus sarasinorum*, described on p. 209 of Mr. R. I. Pocock's volume on Indian Arachnida.]

may have a similar commensal. I examined three nests with negative results. In the bungalow where I am staying branches covered with these webs are placed in vases about the rooms with a view to the destruction of flies and mosquitoes. The spiders seem content in their new locality and have extended their web, but experience did not lead me to consider that they were efficient protectors. Mosquitoes at any rate were plentiful. The commoner species in the bungalow were *Mansonia uniformis* and *M. annulifera*. Other mosquitoes taken here were *Anopheles barbirostris* and *A. fuliginosus*, *Mucidus scatophagoides*, *Stegomyia scutellaris*, *Culex tigripes* and *C. fatigans*, *Tæniorhynchus tenax* and *T. ager*, and *Ædeomyia squamipennis*. Most of the latter were caught at night—in the moth trap.

The mud walls of the bungalow are tunnelled by a small Xylocopid bee (*X. amethystina*). They enter by the natural cracks in the rough wall.

November 8: Found a dung beetle (Coprid) which, besides the usual collection of mites, was infested by a number of small hairy flies. They were clinging to the under surface of its thorax and abdomen and did not attempt to fly away when the beetle was handled, but allowed themselves to be dropped into a tube of alcohol together with their host.

November 10: A large crocodile was seen swimming about in the sea, having been washed out of the mouth of the river and carried away by the tide. It eventually made its way into the Oopah creek.

November 12: While standing on the Admiralty pier I noticed several small shoals of the curious "Bat fish" (*Platax vespertilio*). They would swim in the vertical position for a time, and then all turn over on their sides and drift along, for a space, before resuming the normal position. It had a most weird effect, and at the first glance I mistook the sudden increase in apparent size to be a distortion effect, due to the ripples in the water.*

E. ERNEST GREEN.

Additional Note.—Mr. Green writes under date 25th March, 1907: "In my last 'Notes by the Way' [*Spolia Zeylan.*, vol. III., 1906, p. 219] I mentioned a Muscid fly that captured and apparently preyed upon living winged termites. I can now supply its name: *Ochromyia jejuna*, F." With reference to this matter Professor E. B. Poulton, F.R.S., in his work entitled "Predaceous Insects and their Prey," Part I., in the Trans. Entom. Soc., London, 1906, p. 394, makes the following remarks: "The Muscinæ are not admitted

* When young this fish resembles a dead leaf in its floating movements and colour markings, as described in this Journal, vol. II., p. 52.—Ed.

among predaceous Diptera, the structure of the mouth part being different from that in flies which attack and kill other insects ..... During the past summer (of 1906) I received through the kindness of Mr. E. Ernest Green a female example of the abundant fly *Ochromyia jejuna*, together with a winged termite identified by Mr. W. F. Kirby as *Termes taprobanes*, Hg. The insects had been taken at Welfawaya, Ceylon, in November, 1905, and Mr. Green described the termite as the prey of the Muscid." Colonel Yerbury, who determined the fly, is still sceptical as to the correctness of the observation, but Mr. Green points out that it has been independently confirmed in India (Secunderabad) by Captain K. E. Nangle, 96th Berar Infantry, who published the following note (quoted by Professor Poulton) in the Journ. Bombay Nat. Hist. Soc., vol. XVI., 1905, p. 747, dated 17th July, 1905: "Last night after heavy rain there was a large flight of flying ants at about 9.30 P.M. After the swarm appeared we heard a loud humming noise and went out into the verandah to see what it was and found these flies [*Ochromyia jejuna*] in swarms. We at first thought from the noise, until we caught some, that it was bees swarming, although it was so late at night. We found these flies were hunting the flying ants, regularly hawking at them in the air. When a fly seized an ant it proceeded to devour the soft hind quarters." Colonel Yerbury adds in a letter to Professor Poulton: "The tongue of *O. jejuna* and *O. fuscipennis* is an extraordinary organ, but it is not that of a predaceous fly, but more closely resembles that of *Glossina* without the piercing tip which the Tsetse flies possess. Possibly this is the explanation of my observation [made on the verandah of the resthouse, Kanthalai, 19th October, 1890] in Ceylon of these flies taking away grains of sugar from large ants (*Lobopelta* and *Camponotus*), *i.e.*, that the tongue acts as a suction pump."

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10. *Freshwater Sponge and Hydra in Ceylon.*—Both a freshwater sponge and a Hydra have been known for some years to occur in the tanks and ponds of the Botanic Gardens at Peradeniya, according to information received from Mr. E. E. Green. I have also taken a very few Hydræ in the freshwaters of Colombo, including the Colombo lake, during the past four or five years, having searched for them for the purpose of demonstrating them to the students of the Medical College. Up to the present time there has been no definite published record of the occurrence of a sponge or of a Hydra in the freshwaters of Ceylon, and it is desirable that there should be one in the interests of geographical distribution.

With regard to the sponge, I found a green-coloured species growing luxuriantly upon the stems of water plants near the outlet of the Maha Rambaikulam between Vavuniya and Mamadu.

(Northern Province) in April, 1904. Stretched across the wide exhalent canals were delicate transparent diaphragm-like membranes, each perforated by a round osculum; these membranes vanished in specimens killed in formalin, but were beautifully preserved in strong alcohol. They did not survive the journey to England, where I took the specimens last year, but as the mass of the sponge was crowded with innumerable seed-like reproductive gemmules, it was readily identified by Professor Arthur Dendy, King's College, London, as being the species *Spongilla carteri*, Bowerbank (Proc. Zool. Soc., London, 1863, p. 469, pl. XXXVIII., fig. 20).

A table of the distribution of Indian Spongillidæ has been published by Dr. Nelson Annandale in the Journ. Asiat. Soc. Bengal, vol. II., 1906, p. 56, from which we learn that *S. carteri* has been previously recorded from Bombay, Chota Nagpur, Central India, Calcutta, Madura (Malay Archipelago), Mauritius, and Eastern Europe. In another interesting Paper on "Some Animals found associated with *Spongilla carteri* in Calcutta,"* Dr. Annandale mentions that a fish of a new species and of remarkably small size, 16 millimeters being the length of a spawning female, "lays its eggs in depressions on the surface of the sponge towards the end of the cold weather."

More recently (June, 1907) I have met with abundant growths of the freshwater sponge, both massive and encrusting, occurring on trunks and branches of trees, high and dry, as much as three feet above the reduced level of the water of the tank at Horowapotana in the North-Central Province, between Trincomalee and Anuradhapura. The specimens were, to outward appearance, quite desiccated, but were chiefly composed of myriads of the whitish reproductive gemmules, loosely held together by the spongy framework, by which these freshwater sponges are able to survive the dry season and regenerate when the rains come. The substance of the dried sponges is exceedingly friable, and it was with some difficulty that I succeeded in conveying a good example of the massive form to Colombo.

The grayish brown Hydra of Ceylon has only a few tentacles, as far as I remember five or six, but I have not observed the reproductive organs and can therefore only say that it seems likely that it will prove to be identical with the *Hydra orientalis* of Dr. Annandale. (The Common Hydra of Bengal, its systematic Position and Life History. Memoirs Asiat. Soc. Bengal, vol. I., No. 16, pp. 339–359, 1906.)

April 19, 1907. A. WILLEY.

* Journ. Asiat. Soc. Bengal, II., 1906, p. 187; see p. 201 of the same number for description of the fish *Gobius alcocki*, Annandale.

11. *An expedition to Hambantota.*—I had been in Ceylon almost exactly two months when, in July, 1902, a Boer officer, Commandant Paul Krantz, prisoner of war on parole, came to the Museum and offered his services in mounting and remounting specimens of natural history, for a period of three months. It may be explained that Mr. Krantz had been a professional hunter of big game in South Africa, an expert taxidermist, and field naturalist. In exotic Museums there is frequently a difficulty in the mounting of mammals on the spot, that is to say, in the country of their origin, the first tendency being to regard the skin as a pillow-case which has to be filled with stuffing at all hazards. It is therefore a great advantage when the local taxidermist is able to obtain first-hand instruction in European methods, but this is usually impossible without first making the journey to Europe. The fortunes of war enabled us to overcome the latter obstacle, and if the reader knows anything about the organization of European Museums, he will not be surprised to learn that Commandant Krantz's offer was accepted.

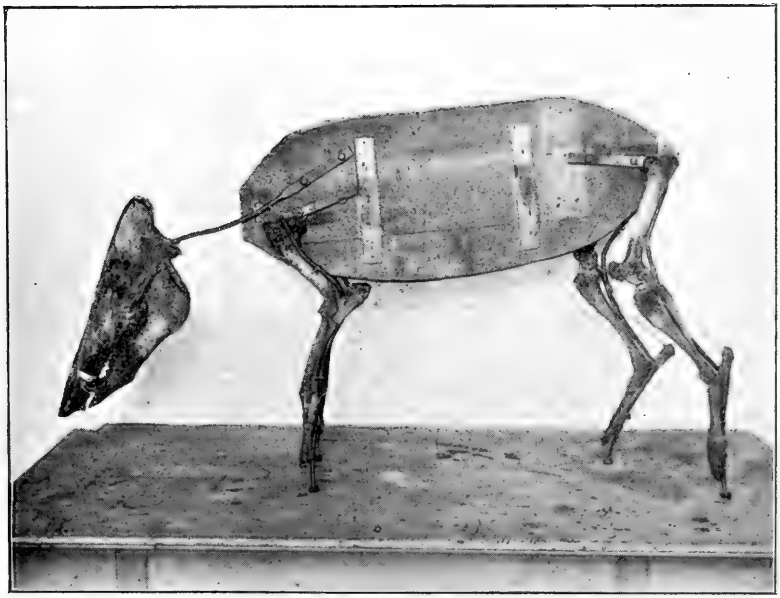
In course of time it became evident that there would be little reason in putting new stuffing into old skins, and a Museum expedition to Hambantota was undertaken in the following September, two double bullock bandies being engaged at Matara. At Tangalla, the circumstances being favourable and the surroundings picturesque the expedition was photographed in memory of an occasion not likely to be repeated. In the accompanying plate the gallant Commandant is seen standing at ease with right arm upraised.

The expedition was successful in its objects, as I reported in my Administration Report for that year, and the introduction of the more modern methods of mammalian taxidermy to the Colombo Museum, as exemplified in the prints of a wild boar, which was procured later, dates from this time. The form of the animal is moulded in clay and plaster of Paris upon a wooden and straw padded foundation shaped according to accurate measurements. The skin is subsequently stretched over the solid model.

April 22, 1907. A. WILLEY.

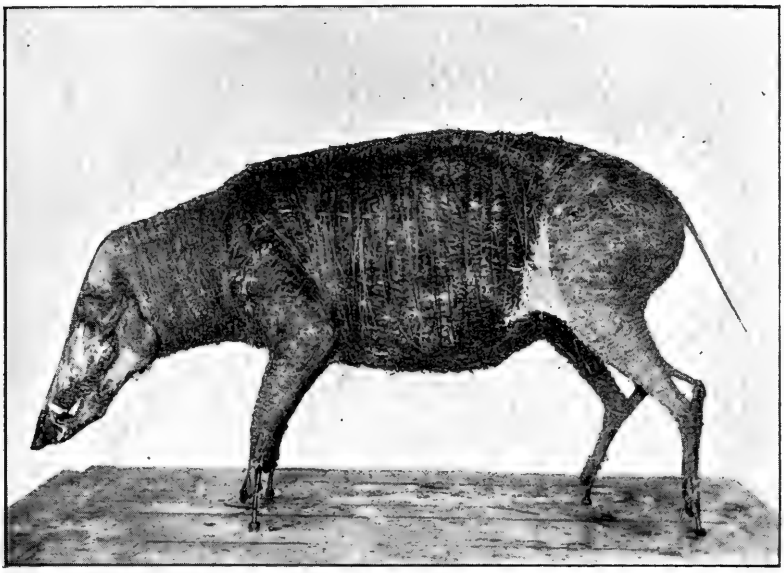
12. *Hikanala and Jivama.*—Mr. V. A. Julius has been good enough to send me papers and correspondence which he has collected regarding the alleged poisonous properties of the Brahminy Lizard (*Mabuia carinata*), and has suggested that the matter, to which reference has already been made in these pages (*Spolia Zeylanica*, vol. III., 1906, p. 231), should be brought up for further discussion. The principal reason for reviving this subject, which is a matter of strong local belief, and therefore perhaps hardly amenable to scientific treatment, is that fifteen deaths of persons from the bite or scratch

OUTSIDE THE RESTHOUSE AT TANGALLA, 1902.

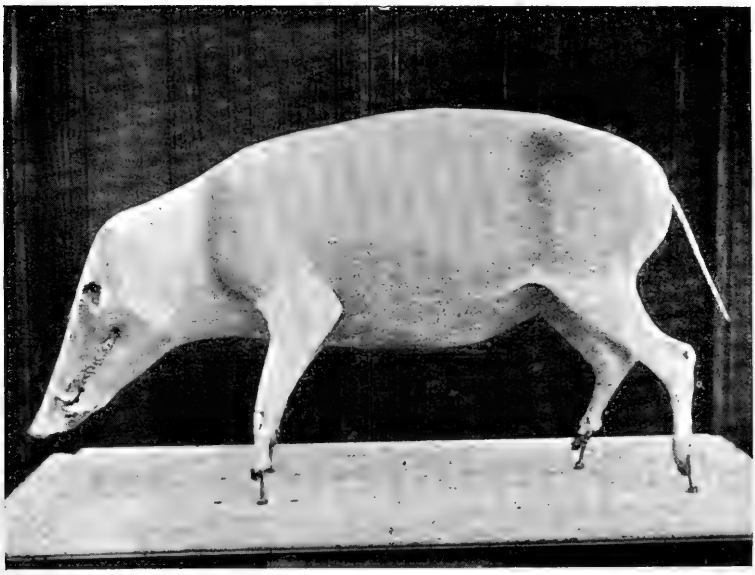


H. F. Fernando,] [*Taxidermist.*

WILD BOAR: FIRST STAGE OF MOUNTING.



SECOND STAGE OF MOUNTING.



THIRD STAGE: THE SOLID MODEL.

of this lizard have been registered in the Vital Statistics during the last ten years, a fact to which Mr. Julius drew public attention in a letter to the "Times of Ceylon," dated 20th October, 1906. It seems to be assumed that because the deaths are attributed to the lizard, therefore they must be due to it, there being no suggestion of a faulty diagnosis. As a matter of fact the belief is interesting as folklore and as illustrating the tenacity of Brahminical mysticism in the affairs of common life.

If the following extracts from the papers which Mr. Julius has placed at my disposal do not speak for themselves, nothing more can be done from this side. So many deaths are reported as due to the hikanala, but how many are registered as being due to the effect of *jivama ?* The answer is : Not one. I do not wish for one moment to cast ridicule upon this tradition. Its recognition in the serious columns of the Vital Statistics up to the present year of grace is indeed extraordinary, and may provide matter for a future chapter in zoological mythology. Having referred to the effects of *jivama* or sorcery, I may recount an incident which was related to me the other day by the Hon. Mr. G. M. Fowler, C.M.G., how that a *huniyam* charm* in the form of an ola with cabalistic characters on it, directed against a servant in his employ at Jaffna some twenty-five years ago, had been buried at the entrance to the godown. The first living thing to pass over it the next morning was a valuable deer hound. Before the day was out the dog was accidentally shot, and the servant said that the dog, having passed over first, had saved his life. The charm was there and a life had been lost, *post hoc ergo propter hoc.*

Mudaliyar A. Mendis Gunasekera quotes the case of the death of a girl thirteen years old in the Galle District "by poison caused by a hikanala licking one of her toes."

The Trustee of the Jayawardhana Kotte Raja Maha Vihare gives a list of seven [a mystic number] varieties of the lizard : Tel-hikanala, with oily scales ; Le-hikanala, bright red colour ; Petideka-hikanala, the double-tailed hikanala known to be very poisonous ; Penda-rata hikanala, with a red tail [the Brahminy Lizard has a red tail when very young] ; Polon-hikanala, spotted like the polonga ; Kalu-hikanala, the black variety ; Gerandi-hikanala, "the largest and the most harmless species, running away at the approach of man." It is possible that several species of skinks are indicated by these names. The correspondent adds : "It is stated in medical works dealing [with] snakes and their poisons that hikanalas are often hatched from the eggs of cobras, polongas, and mapilas, all highly venomous snakes." I will not quote further from this part of the testimony, but will state for the public benefit that whatever the

* I am told that the term *huniyam* may be applied to all injurious charms which are buried in the ground.

Sanskrit medical works may say, it is known in zoology that such equivocal generation is impossible in the animal kingdom. The writer quotes from ancient works which "point to the fact that for over 2,500 years the Brahmin Lizard has been known to be a poisonous animal. The Sinhalese, Tamil, and Hindu writers on snake poison are agreed that although [it] is not known to possess poison bags like other snakes, yet his bite, scratch, or a touch of the saliva is highly poisonous. . . . When one is bitten, clawed, or licked by this reptile the most ordinary symptoms of poison are pains in the chest, giddiness, senselessness, trembling of the limbs, foaming at the mouth, &c." Then follows a list of persons named, who have been bitten, some of whom recovered and some died. It is most strange that the crucial demonstration is lacking in every single instance. In each case the identity of the person and the actuality of the death cannot be doubted, but where is the lizard? Probably no where except in the mouths and minds of the witnesses at the inquest.

I have given in the foregoing lines my presentation of the case. So long as the Brahminy Lizard figures in the Vital Statistics it will be a matter of public importance for investigation by the Medical Department.

Colombo, April 17, 1907. A. WILLEY.

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13. *Stone Implements in Vedda Caves.**—Following your kind invitation to give some account in the "Ceylon Observer" of our recent scientific expedition in this Island, it may interest your readers to know that we have just returned from a lengthy journey into the Vedda country in the eastern low-country of Ceylon. This trip we made for the express purpose of solving the problem as to whether there existed in the caves formerly as well as presently inhabited by Veddas, any industry in the making of stone implements representing in itself the Stone Age of the Veddas, and including that of Ceylon.

Many careful studies, undertaken by English residents as well as by ourselves, led to the conclusion that the Veddas are a human species of a lower and older type than the other inhabitants of Ceylon, namely, the Sinhalese and Tamils; and that they must represent the few remnants of the aborigines of the Island, who were met with by the Sinhalese on their first arrival and were called by them Yakkas, according to the old tradition preserved in the *Mahawansa*. If this were true, it is necessary to presume that these aborigines were living in a Stone Age at the time when their Island for the first time was invaded by a race of a higher cultivation, and

* Republished from the "Ceylon Observer" for 22nd April, 1907, by kind permission of the proprietors.

that it would be certainly most desirable to discover the stone implements in the caves or elsewhere, for dissipating the last doubts about the autochthony of the Veddas.

Now, as former efforts, undertaken as well by British residents as by ourselves, failed to realize the desired result, inasmuch as we could not find any notice about such a discovery in the whole anthropological literature, we resolved to undertake a new expedition into the Vedda country—on the whole the fourth of our Vedda expeditions—with the special purpose named.

This time we have been lucky enough to find a cave, near the village Nilgala, till a short time ago still inhabited by Veddas, the soil of which we found contained in great abundance stone implements of a very rough kind.

Further investigations of some other caves, one near Kataragam, the other near Kalodai, led to an identical result. Also, we succeeded in discovering upon the hilltops of the country of Upper Uva the same rough stone implements in great quantities and still well preserved. So that not only the autochthony of the Veddas can be regarded as a proved fact, but also their former distribution over probably the whole Island, the low-country as well as the mountainous districts of it.

Let us here say something about this stone industry. As already remarked, these stone chips are of a very rough kind, belonging to the older or Palæolithic Stone Age, following the distinction established by Sir John Lubbock, now Lord Avebury. The shape of the chips, knives, points (lance points), scrapers, and fragments of bone awls enable this stone industry to be determined as belonging to the third period of the Palæolithic Age, the Magdalenien of G. de Mortillet.

Yet this industry is to be denoted as a special *Facies Veddaica*, inasmuch as the white quartz, for a great deal of an ice-like transparency, furnished the principal part of the material.

Besides this, we also found a red, yellow, and black variety of quartz (jasper) employed in great profusion, which so coloured chips made a strange appearance within those caves formed by the monotonous gray gneiss rock of the Island. On the whole, these stone implements are of a small size to be used by small hands, and therefore by a small-sized type of mankind. In the same manner the nice stone hammers, which served to strike off the chips from the so-called nuclei or mother stones and of which we got as many as forty, are of a remarkably small size.

In opposition to the opinion often times repeated (chiefly by linguists and by some anthropologists, who did not think it worth while to study the question to the bottom), that the Veddas would represent nothing else than some hordes of degraded Sinhalese, we repeat that we must now maintain that the autochthony of the Veddas in Ceylon is a proved fact; and further that the Sinhalese, when they first came into the Island, already had iron, which they

brought with them, and that this much better material was taken over by the Veddas in a relatively short time.

We, furthermore, may already venture to say that the second main period of the Stone Age, the Neolithic one, viz., that characterized by the polished stone axe, is entirely wanting in the Island of Ceylon, the Veddas having made the step directly from the older Stone Age into the modern Age of Iron, which was brought them, as remarked above, by the Sinhalese, or perhaps by another people of the Indian Continent.

F. and P. SARASIN.

Kandy, April 19, 1907.

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14. *Further Note on Vedda Implements.*—A number of pieces of chert, quartz, &c., were recently brought to the Museum as mineral specimens for examination and determination by one M. Palis Perera, who collected the majority of them in the district between Badulla and Batticaloa.

A large number of the specimens proved to be fragments of common rocks and minerals of no special interest, but others were obviously paleolithic implements or showed some signs of human workmanship; and on questioning Perera he stated that he collected them during the recent expedition of the Drs. Sarasin to the Vedda district, when he was employed as shikari.

Out of a total of over 108 packets of specimens, only about eighteen appear to be undoubted human implements, being of more or less recognized shape and showing work on the edges; eleven of these are of red, brown, or light-coloured chert with dull surface; two consist of transparent quartz; and five of pieces of the red brown chert with bright surface and good conchoidal fracture, known in Sinhalese as *gonapitta* or *ginigala*, being the material formerly used for gun flints. There is no example of green chert among these, though some very doubtful specimens are composed of this material. The green chert is markedly softer than the other varieties.

Some of the specimens were found in a Vedda cave at Nilgala, in which case the presumption that they have human association is considerably strengthened in the case of otherwise doubtful examples.

The implements are small and badly fashioned, suggesting rather eoliths than paleoliths, certainly not paleoliths of the Magdalenien type to which the Drs. Sarasin refer their examples.

The specimens may be described as spear heads, arrow heads, scrapers, and one borer, the latter closely resembling the eoliths figured by Professor Sir E. Ray Lankester in his recent book entitled "The Kingdom of Man" (London, 1907).

July 8, 1907. JAMES PARSONS.

15. *Fungus Gardens of Subterranean Termites in Ceylon.*—A translation of an article by Dr. Doflein on this subject appeared in *Spolia Zeylanica* in April, 1906 (vol. III., p. 204), under the heading "Termite Truffles," the latter word being a not very well-chosen approximation to the German "Pilzkuchen;" "Termite Combs" would have been more accurate.

The matter has been investigated with great success by Mr. T. Petch, who has published an exceedingly interesting and beautifully illustrated memoir entitled "The Fungi of Certain Termite Nests" in the Annals of the Royal Botanic Gardens, Peradeniya, vol. III., part II., November, 1906. Mr. Petch's conclusions are in some important respects in disagreement with those of Dr. Doflein, and his Paper, which contains a bibliography, should be consulted by those who wish to know more about this remarkable association between fungi and termites. From Mr. Petch's Paper it appears that the chief edible mushroom of Ceylon grows from the combs of *Termes redemanni* and *T. obscuriceps*.

April 22, 1907. ED.

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16. *Re-duplication of Queen in Termite's Nest.*—The presence of supplementary queens—or of partially developed queens—in termites' nests is, I believe, of not uncommon occurrence. But the re-duplication of the queen in a single royal cell is more remarkable. A nest of *Termes obscuriceps* was recently dug up in the Botanic Gardens at Peradeniya. On opening the royal cell two fully developed queens were found lying side by side. No males were present. If these were not accidentally lost, at the time of opening the cell, it seems possible that two females were originally imprisoned in mistake for the usual sexual pair. In that case fertilization must have taken place—once for all—before the imprisonment.

Peradeniya, April 19, 1907. E. ERNEST GREEN.

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17. *Boring Power of Land Leeches.*—The blood-sucking habits of the common land leech are well known, and its powers of biting through the human epidermis to reach the coveted supply of fluid. But the ability of this creature to perforate a much tougher substance came as a surprise to me. I happened to imprison a full-grown leech in one of the round glass-topped cardboard boxes commonly employed by entomologists. Twenty-four hours later, the leech was found to have escaped through a hole perforating the double stout card (fully a millimetre in thickness). The hole measured 10 millimetres in longest diameter and was cleanly cut, the excised portion having apparently been reduced to powder.

Peradeniya, April 15, 1907. E. ERNEST GREEN.

18. *Adam's Bridge* (*extract from "The Face of the Earth," by E. Suess, translated by Hertha B. C. Sollas, Oxford*, 1904, vol. 2, pp. 511–514).—Quite recent marine deposits....occur, even if only in widely separated patches, all around the Indian peninsula .... On Cape Comorin and beyond it .. the .. signs (of negative movement) .. are .. clearly visible. This region and Adam's Bridge we will now consider in greater detail, in the case of Adam's Bridge with the help of the observations of Foote, supplemented by those of Christopher and Branfill, and by the ancient poems.*

We meet here, at various levels, with horizontal beds of limestone and calcareous sandstone containing the shells of existing molluscan species. One of the most important areas is the Kudung Kudam plateau, situated a little to the north-east of Cape Comorin ; it is a tableland about three kilometers in length, surrounded by sand dunes, and reaching a height of 48·5 metres ; this is, so far as I know, the greatest height, as ascertained by measurement, at which these deposits occur in the south of the peninsula. Most of the patches by which they are represented occur at very inconsiderable heights, and Foote's opinion that they were formed by a late phase of the negative movement finds support in the observations made in other places. Corals do not appear to occur in these deposits, but on the beach itself and on some of the adjacent islands the upper part of the coral reef lies high and dry, covered with sand and soil. Precisely similar coral reefs occur in some parts of the island of Ceylon. In the interior, says Richthofen, they are not exposed at the surface, but the inhabitants often open up quarries in the coral limestone beneath the fields. The north of Ceylon in particular is said to be entirely underlain by coral formations.†

A dead coral reef, according to Foote, forms the island of Rameswaram ; its surface reaches a height of at least 3 meters and probably more. This island forms one of the points of attachment of that remarkable bar which is known as Adam's Bridge. From the dune-covered coast of the peninsula the long mound proceeds first to the south side of the Rameswaram reef, and in this part of its course there occurs, near Paumben, an artificially widened channel which has long served as a passage for ships. So long ago as 1484 (1480 ?) the canal is said to have been destroyed by a storm, as has

* R. Bruce Foote, On the Geology of South Travancore, Rec. Geol. Surv., India, 1883, XVI., p. 30 ; On the Geology of the Madura and Tinnevelly District, Mem. Geol. Surv., India, 1883, XX., pp. 46 and 55–74, map ; Lieutenant Christopher, Accounts of Adam's Bridge, Trans. Bombay Geogr. Soc., 1846, VII., pp. 130–133 ; B. R. Branfill, Physiographical Notes on Tanjore, &c., Journ. Asiat. Soc., Bengal, 1878, XLVII., 2, p. 187.

† F. von Richthofen, Bemerkungen uber Ceylon, Zeitschr. deutsch. geol. Ges., 1860, XII., p. 529 ; also Schlagintweit, Reise in Indien und Hochasien, I., p. 147 (elevation of the whole of Hindustan).

since happened on several occasions; under the English Government it has been deepened. The friable calcareous sandstone of the bar breaks up into great rectangular blocks, and this no doubt gave rise to the belief that it is a colossal causeway of artificial construction. From Rameswaram the mound curves round to the south-east; at first it is a sandy spit sixteen kilometers in length, very flat, and at the time of the south-east (? south-west) monsoon partly submerged. Then a gap begins and continues for 30 kilometers, but troubled by many banks of shifting sand; on this follows a broader bend which almost reaches the island of Ceylon. Everywhere it presents the same friable calcareous sandstone. This bar is the scene of one of the most beautiful episodes in the great epic of Ramayana.

The hero Rama, accompanied by his true-hearted spouse Sita, endures many years of exile in the woods and deserts of Southern India. Then Sita is carried off by Ravana, the King of Lanka (Ceylon). Rama goes forth to wage war against Lanka and to recover his faithful wife; he will throw a bridge across the sea. The "people of the forest, who have the form of apes and fight with trunks of trees and pieces of rock," are his numerous and mighty allies. The host encamps on the strand. Lost in contemplation Rama with his army gazes on the vast ocean; disturbed, and as though kindled by the wind, the world of waters resembles a sea of air, and the air the ocean; far away on the horizon heaven and sea merge into one another, the one adorned with stars the other with pearls. For three nights the never-yet-conquered Rama lingers in deep meditation on the strand, waiting until the god of the sea shall appear to him. Impatient, he seizes at last his bow, and shaking the earth, as it were, looses flaming arrows like living fire into the abysses of the sea; so does Indra hurl his lightning. The waves rise like the mountains of Vindhya and the monsters of the deep fly terrified to the sea-god. The god appears; his colour is like the dark lazure stone, sparkling with gold. He speaks to Rama and says: "It was thine ancestor Sagara who hollowed out for me my bed; therefore I am called Sagaride, the Lord of the streams. I cannot suffer a bridge across my waters, lest others should see that I may be overcome. But if thou willest to throw up a dam, the ape Nala may construct it; neither the creatures of the deep nor storms shall hinder thee, and I will hold back the waves for thy sake and Nala's." *

The command is given and hundreds and thousands of strong apes begin the work. They tear up trees by their roots and throw them, covered with blossom, into the sea, and upon them bushes

* Foote, on the Geology of South Travancore, Rec. Geol. Surv., India, 1883, XX., p. 74; Ramayana, Poema sanscritto di Valmici, tradutto per G. Gorresio. 8vo. Paris, 1856, IX., lib. v., Sunderacanda, pp. 132, 141, 185–192; for the distinction between causeway and bridge, p. 362, note 91.....

and creepers, and then great blocks of rock and again trees, and then again rocks. So the dam is raised; Rama, his brother Lacsmana, and with them Sugriva, Hanumat, and all the other doughty warriors of the army of apes march over the dam to the decisive battle.

Thus, long before the beginning of our era, the poet describes the origin of the bar. As long as the ocean endures, he says, so long will this dam exist and the fame of Rama. Even at the present day a number of small isolated islands are called Nalasetu, *i.e.*, the bridge of Nala; the nearest town of India is called Ramnad, and its Governor bears the title of Setupati, or Governor of the Bridge.

It is possible that some communication between the island and the mainland may have once existed, and have been afterwards destroyed by one of the mighty storms of the Indian Ocean; this might easily have happened independently of any change in the relative level of the strand. A broad band of recent alluvium derived from the mainland has been deposited against the north side of the bar. There is so much sand on this coast that the dunes cover it far and wide. On the recent alluvium, an important river, the Vygah, is completely smothered up by its own sediments and does not again find its way to the light till it is close to the sea. The town of Ramnad stands on this same strip of alluvial land, which is evidently more recent than the western part of the bar between the mainland and the island of Rameswaram. The negative movement which left exposed the corals of Rameswaram as well as those of Ceylon had begun to make itself felt even before the formation of the existing bar.

[Extract communicated by Dr. A. K. Coomaraswamy from the above-named work.]

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