ISOPODA OF THE SIJU CAVE, GARO HILLS, ASSAM.

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In the collection from the Siju Cave four species of terrestrial Isopods are represented, belonging to three genera of the tribe Oniscoidea. Of the family Oniscidae two genera, *Porcellio* and *Philoscia*, live in the cave, while the Armadillidae are represented by a species of *Cubaris*. Of the four species three have been named ; of these, two, belonging to *Porcellio* and *Philoscia*, are believed to represent undescribed forms, while the third appears to be the species that has been described by Collinge[1] under the name *Cubaris cavernosus*. The fourth belongs to *Philoscia* and is inadequately represented in the collection. The names of the species, together with their range inside the cave are given here :—

Oniscidae.		
Porcellio assamensis, sp. nov.	0—450 ft.	from entrance.
Philoscia dobakholi, sp. nov. ...	600—3,600 ft.	,,
Philoscia sp.	800—1,200 ft.	,,
Armadillidae.		
Cubaris cavernosus Collinge ...	300—3,800 ft.	,,

The three named species are fairly common in the cave, but individuals of the large " Pill " Isopod, *C. cavernosus*, are by far the most abundant. In the introductory part of this report Dr. Kemp and I have pointed out that the portion of the cave between 350 and 500 feet from the entrance has the richest fauna, both in numbers of species and of individuals. This is also true so far as the Isopods are concerned. The two species, *P. assamensis* and *C. cavernosus*, that occur in this part of the cave have the largest number of individuals living in this region, and the number falls very appreciably on both sides of it. This is probably due, as has been pointed out, to the abundance of food-supply in this section of the cave.

So far as characters generally associated with cave-life go, the three species of Isopoda collected in the Siju Cave do not show an advanced degree of adaptation to their environment. Of the three, *Philoscia dobakholi* shows the greatest modification ; its colour is almost totally bleached and the eyes are considerably reduced. In *C. cavernosus* also the eyes are partly reduced, but the colouration does not show any indication of a subterranean life. The species lives, however, almost exclusively in the region of total darkness, and extends, with *Philoscia*, up to the inner end of the cave. The third species (*P. assamensis*) seems to be an outside form, which has perhaps invaded the cave but recently and has not yet succeeded in penetrating to any great depth. It has well-developed eyes and a dark colour.

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[1] Collinge, *Rec. Ind. Mus.* XII, pp. 123-124 (1916).

I have not studied the minute structure of the eye in any of the Siju Cave Isopods, but in the general reduction of the optic organ the two species mentioned above seem to resemble in some respects the snail *Opcas cavernicola*, the structure of the eye of which has been studied in detail by Dr. Annandale and myself. Only the visible portion of the optic apparatus of this snail, however, as has been pointed out by us, is reduced, though in about 6 per cent of the individuals the eye is totally unpigmented. In the prawn *Palaemon cavernicola* also the eyes are much smaller than in closely allied outside forms, but the visual elements show no sign of degeneration.

Two cave Isopods are already known from Assam. *Cubaris cavernosus*, now recorded from Siju also, was originally described from a cave near Cherrapunji in the Khasi Hills. The other, *Burmoniscus kempi* Collinge, was collected in the Maosmai Cave in the same district.

Genus **Porcellio** Latreille.

The genus is very closely allied to *Oniscus* Linn. from which it differs principally in having a two-segmented antennal flagellum and the opercular rami of two or more pleopods provided with air-cavities. The genus comprises a very large number of species, Budde-Lund alone describing or mentioning about ninety of them in his *Isopoda Terrestria*.

Except for the form that Collinge[1] recorded from South India under the name *P.* sp., the genus *Porcellio* is, so far as I am aware, not hitherto known from India. The same author[2] described a species from Allahabad under the name of *P. immsi*, but he later[3] referred it to his new genus *Hemiporcellio*, and also added to it two other species, *H. carinatus* and *H. hispidus*, collected from the shores of the Chilka Lake. Chilton[4] has also recognized *Hemiporcellio* as distinct from *Porcellio*, and has referred to Collinge's *H. carinatus* two specimens collected from a small island in the Chilka Lake. No diagnosis of the genus as distinct from that of the species has hitherto been given, and on examination of Chilton's specimens I have not been able to find any strongly marked characters by which the two genera can be easily distinguished.

Verhoeff[5] has recently split up the genus into a large number of subgenera, but I am somewhat doubtful of the utility of this arrangement, as, apart from all other considerations, it seems likely to introduce more confusion than ever in this already perplexingly large genus. Budde-Lund[6] also has set up about twenty-one sub-genera, based principally upon the denticulation of the outer lobe of the first maxilla.

The species from the Siju Cave resembles *P. maculipennis* Budde-Lund,[7] but so far as I can make out from the brief description of the latter, unaccompanied by any figures, the two appear to be distinct. Budde-Lund's species was collected at Palon in Burma.

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[1] Collinge, *Rec. Ind. Mus.* XI, p. 144 (1915).
[2] Collinge, *Ann. Mag. Nat. Hist.* (8) XIV, pp. 207, 208, pl. ix, figs. 1-9 (1914).
[3] Collinge, *Rec. Ind. Mus.* XI, p. 145 (1915).
[4] Chilton, *Mem. Ind. Mus.* V, p. 477.
[5] Verhoeff, *Sitzungsb. Ges. Naturf. Freunde Berlin*, 1907, p. 245 (1907); and *Jahresh. Ver. Vaterl. Naturk. Wurtt.* LXXIII, p. 166 (1917).
[6] Budde-Lund, Isopoda in Voeltzkow's *Reise in Ostafrica, Wiss. Ergeb.* II, p. 281 (1909).
[7] Budde-Lund, *Ann. Mus. Civ. Stor. Nat. Genova* (2) XIV, p. 608 (1894).

Porcellio assamensis, sp. nov.

Body somewhat oval, elongated, with its greatest breadth markedly less than half its length. Dorsal surface slightly convex and covered with fine grannules aggregated especially along the sides of the thorax, and with large tubercles arranged in two sub-median rows.

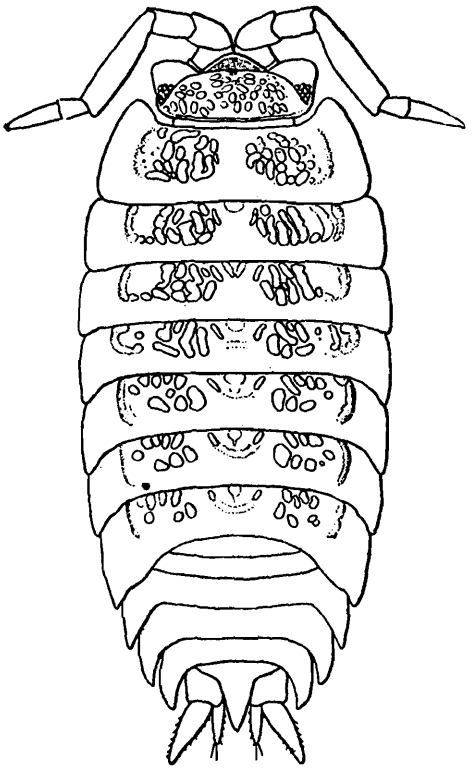

Fig. 1.—*Porcellio assamensis*, sp. nov., dorsal view: × 10.

Cephalon distinctly separated from the first thoracic segment, and surrounded to some extent by the forwardly projecting lateral parts of the latter. Breadth somewhat less than half the length. Anterior margin conically produced in the middle; lateral lobes large, prominent and bluntly rounded at their free margins. Surface of the head beset with large tubercles. Eyes well developed, oval, situated at the sides of the head at the base of the lateral lobes.

Thoracic segments large, sub-equal, convex from side to side, their lateral parts prominent, lamellar, subcontiguous, those of the first segment projecting anteriorly so as to enclose the head on its sides, and extending almost as far forwards as the base of the lateral lobes. Lateral parts of the anterior three segments terminating behind bluntly, those of the last four more or less acutely.

Pleon less than half the length of the thorax and only slightly narrower. All the six segments distinct, the first two considerably shorter than the rest, their lateral parts entirely concealed by the seventh thoracic segment. Lateral parts of the third, fourth and fifth segments well developed, narrow, lamellar and strongly curved back; those of the last extending considerably beyond the middle of the terminal segment. Sixth segment triangular, with the apex drawn out posteriorly in a long pointed process; length somewhat less than the breadth at the base.

Antennules (Fig. 2*a*) small, insignificant, three-segmented, with second segment proportionately small, terminal smaller than the basal, conically tapering and provided with a small number of apical cilia.

Antennae (Fig. 2*b*) somewhat short and rather strongly built, hardly ever reaching beyond the end of the second thoracic segment when fully turned backwards. Peduncular segments, especially the first four, deeply grooved ventrally; first three short, fourth about one and a half times longer than third, fifth longest, more than twice the length of the third. Flagellum shorter than the last peduncular joint; two-segmented, with the terminal segment considerably more than twice the length of the basal. All antennal segments covered with hairs—peduncular somewhat sparsely, flagellar more densely. Last flagellar segment provided

at its tip with a stout, styliform bristle, dividing distally in a compact penicil of fine setae.

Epistome convex, conically produced and provided with setae.

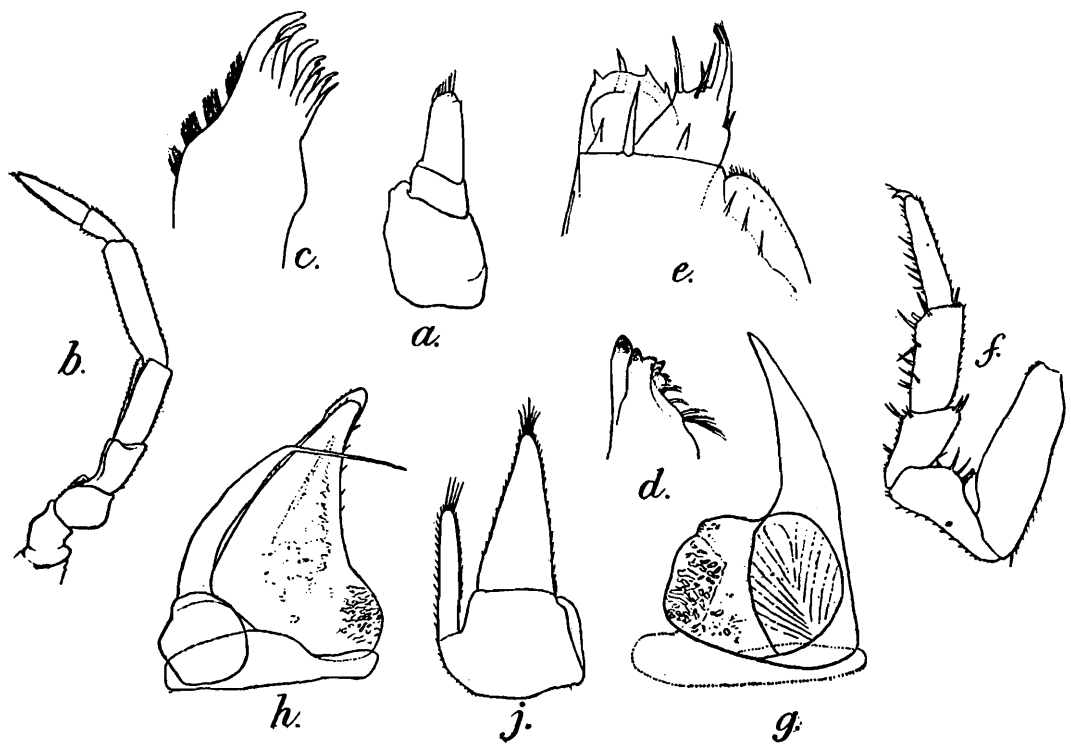

FIG. 2.—*Porcellio assamensis*, sp. nov.

a. Antennule : × 85
b. Antenna : × 15.
c. Terminal portion of outer lobe of first maxilla : × 85.
d. Terminal portion of mandible : × 50.
e. Terminal portion of maxilliped : × 85.
f. Thoracic leg : × 25.
g. First pleopod of male : × 35.
h. Second pleopod of male : × 35.
j. Uropod : × 35.

Outer lobe of first maxilla (Fig. 2*c*) terminating in four large incurved spines, the outermost the largest, and four shorter spines bifid at their extremities. Part of outer margin behind the outermost large spine deeply setose.

Mandibles (Fig. 2*d*) with a double row of strongly chitinous teeth at the apex, a membranous hairy lappet behind, followed by a number of "penicils."

Maxilliped (Fig. 2*e*) with the outer palp terminating in a large multispinous process, with one or two small spines on its outer side, and two large and two small ones on the inner side. Inner palp broad, with three blunt tooth-like spines having broad bases, and one large pointed spine in the middle. A large pointed spine at the base of the outer palp at its inner margin, and a smaller one about its middle. Outer margin of maxilliped behind the palp provided with a number of short spines.

Legs (Fig. 2*f*) increasing in size from first to last ; last pair in male hardly stouter than in female, with the carpal joint rather dilated. All legs strongly setaceous.

Opercular rami of all five pairs of pleopods provided with air-cavities ; those of the first two pairs in the female somewhat bilobed. First pleopod of male (Fig. 2*g*) with exopodite less than half the length of

endopodite ; the former a rectangular plate, the latter with the basal half broad, provided with powerful muscles, and with the distal half narrowing to an acute point. Second pleopod of male (Fig. 2*h*) with its exopod longer than that of the first, triangular, its apex pointed, outer margin bearing a small number of short spinules ; the endopod consisting of a broad, rounded basal joint, followed by a long narrow second joint curving outwards to an acute point, and reaching considerably beyond the end of the exopod.

Uropoda (Fig. 2*j*) extending considerably beyond the telson ; basal segment somewhat flattened dorso-ventrally, narrower posteriorly than at its anterior margin and extending up to about the middle of the telson ; the inner ramus narrow, linear, arising from the inner lateral corner of the basal plate, extending beyond the middle of the outer ramus, setaceous and terminating in a tuft of about four long setae ; outer ramus distinctly longer in male than in female, articulating at the posterior margin of the basal plate, broad at the base, fairly thick, tapering to an acute point, considerably longer than the basal joint, provided with setae along the margins and terminated by about six long hairs.

Colour dark brown on dorsal surface, with white opaque patches arranged submedianally on the thorax. Colour somewhat lighter in some specimens, probably varying with age.

Length of adult up to 8 mm.

The species does not extend far into the cave, having been met with only up to 450 feet from the entrance. The types are from 400 feet and are registered in the collection of the Zoological Survey of India under No. C 555/1.

Genus **Philoscia** Latreille.

This genus also is closely allied to *Oniscus*, but is easily distinguished from it by the absence of well-developed lateral lobes on the head, the less expanded lateral parts of the thoracic and abdominal segments and the abruptly narrowing abdomen. From *Porcellio* it differs in having a three-segmented antennal flagellum. The genus comprises quite a large number of species, Budde-Lund alone describing over 20 of them in his *Crustacea Isopoda Terrestria.*

From India proper, so far as I know, only one named species of this genus has been described, at least in recent years. This is *P. tenuissima* Collinge[1] from Madras. The same author[2] has also recorded two other species from N. E. Assam and the Abor country, but was unable to give them specific names. Another form, also unnamed, is recorded by Collinge[3] from the Andamans. A species from the Mouimein Caves in Burma has been described by Budde-Lund[4] under the name *P. coeca*, but, so far as I can make out, it does not agree with the Siju cave form. The latter may, however, possibly be identical with Collinge's *P.* sp. 1 or *P.* sp. 2 from Assam.

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[1] Collinge, *Rec. Ind. Mus.*, XI, p. 145, pl. v, figs. 1—10 (1915).
[2] Collinge, *Rec. Ind. Mus.*, VIII, pp. 465, 466 (1914).
[3] Collinge, *Rec. Ind. Mus.*, X, p. 207 (1914).
[4] Budde-Lund, *Ann. Mus. Civ. Stor. Nat. Genova* (2) XIV, pp. 611, 612 (1894).

Budde-Lund[1] and Sars[2] attach considerable importance to the number of " penicils " behind the cutting part of the mandible. In *Philoscia* there is said to be a single " penicil," while in *Oniscus* the number of such structures always exceeds one. Chilton[3] also seems to consider this character of great importance, for he regards the generic identity of *Oniscus punctatus* Stimpson as doubtful only because the mandibles in this species do not bear a number of " penicils " behind the cutting part, he having found one on each mandible, " though another one or sometimes two are situated on the setose membranaceous lappet just internal to the cutting edge." Budde-Lund suggests that this species may possibly belong to *Philoscia*, but as Chilton points out the presence of well-marked lateral lobes on the head and a number of other characters are against this view. In the Siju Cave species, described below, the condition is exactly like that described by Chilton—two penicils arising from the membranous lappet, a single penicil behind, followed, at some distance, by the usual large, curved penicil.

Philoscia dobakholi, sp. nov.

Body oblong oval, somewhat widening in an antero-posterior direction, attaining its greatest breadth at about the posterior end of the thorax. Breadth less than half the length. Dorsal surface convex, shining, smooth, not provided with tubercles or granules.

Cephalon distinctly separated from the first thoracic segment and less than half as broad as long. Frontal margin regular, only slightly arched; median lobe absent. Antero-lateral corners of the head rounded and not produced into projecting lateral lobes. Eyes greatly reduced, composite, formed of a small number of eye-spots aggregated together and situated in the antero-lateral angles of the head.

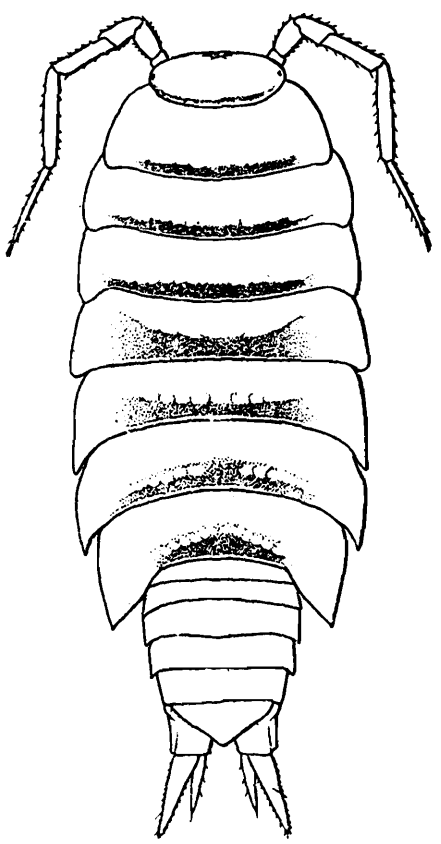

FIG. 3.—*Philoscia dobakholi*, sp. nov., dorsal view : × 10.

Thoracic segments large, slightly convex from side to side. First segment longest, its anterior and posterior margins strongly curved, the former rounded and projecting appreciably beyond the sides of the head. Remaining segments sub-equal, fifth and sixth widest. Side plates of first three segments rather poorly developed, posteriorly rounded; those of the last four successively increasing in size, posteriorly drawn out and terminating in somewhat sharp points. Side plate of the last segment reaching up to, or even beyond, the posterior border of the third abdominal segment.

[1] Budde-Lund, *Crust. Isop. Terrest.*, pp. 202 and 207 (1885).
[2] Sars, *Crust. Norway* II, Isopoda, pp. 171 and 172 (1899).
[3] Chilton, *Trans. Linn. Soc. London* (2) VIII, p. 134 (1901).

Abdomen small, a little less than one-fourth of the total length of the body and abruptly much narrower than the thorax. All the six somites distinct, the first appreciably smaller[1] than the rest, with its lateral parts almost entirely concealed by the seventh thoracic segment. Second segment also somewhat smaller than the rest, its lateral parts generally free. Lateral parts of third, fourth and fifth somites very small, slightly projecting posteriorly. Terminal somite of about the same length as that preceding it, sub-triangular, terminating in a blunt point posteriorly and extending beyond the middle of the basal segment of the uropod.

Antennules (Fig. 4*a*) extremely reduced, three-segmented, with the two basal segments broad ; second comparatively short ; terminal longer than the basal, conically tapering, provided with cilia along its margin and a tuft of two or three longer cilia at the apex.

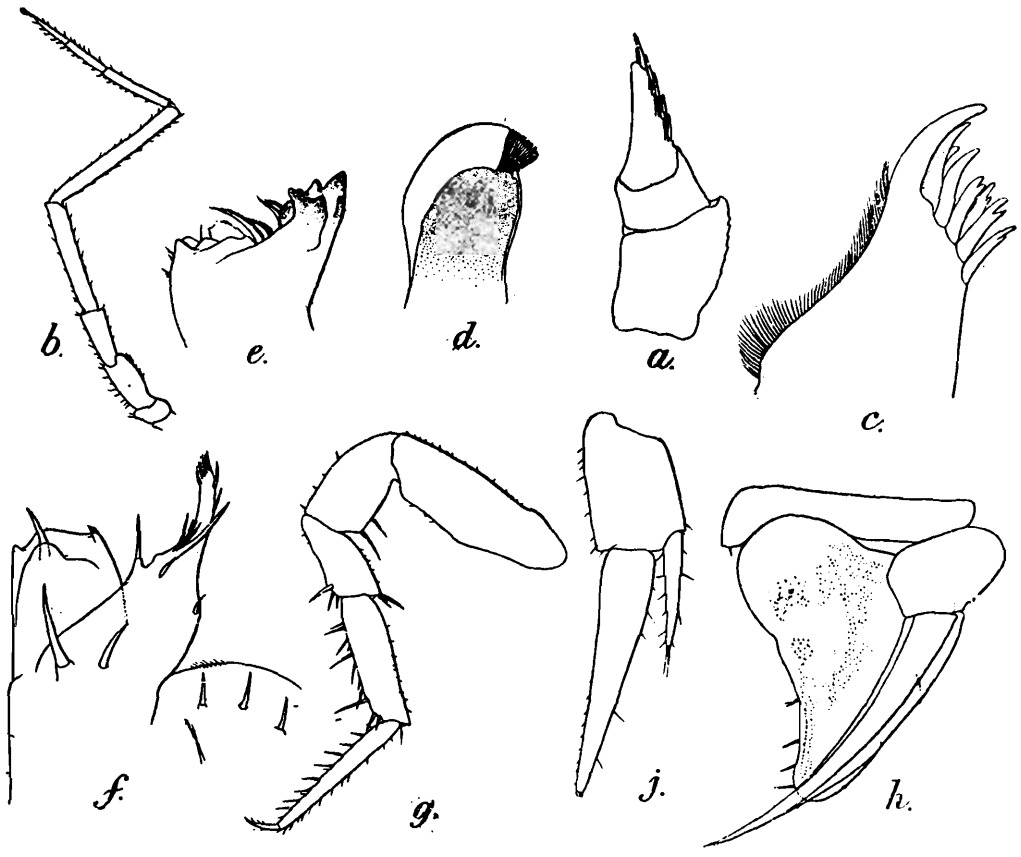

FIG. 4.—*Philoscia dobakholi*, sp. nov.

a. Antennule : × 85.
b. Antenna : × 10.
c. Terminal portion of outer lobe of first maxilla ; × 85.
d. Terminal portion of second maxilla : × 40.
e. Terminal portion of mandible : × 50.
f. Terminal portion of maxilliped : × 85.
g. Thoracic leg : × 14.
h. Second pleopod of male : × 35.
j. Uropod : × 25.

Antennae (Fig. 4*b*) long and slender, reaching almost to the end of the third thoracic somite when fully turned back. Peduncular joints not grooved ventrally ; first joint short ; second and third also short ; fourth

[1] In two specimens the first abdominal segment is fairly large and its margins are not appreciably concealed by the last thoracic segment.

almost as long as the basal three put together; fifth longest, more than three times longer than the third. Flagellum longer than the last peduncular joint, three-segmented, with the first segment longest, second and third subequal. All the segments sparsely provided with cilia along their margins, and the terminal flagellar joint with a stout styliform bristle, dividing distally in a compact penicil of fine setae.

Outer lobe of the first maxilla (Fig. 4*c*) terminating in four large curved spines, the outermost being the largest, and four more almost straight, only a little shorter than the innermost curved spine, and having their free extremities deeply bifid. Outer margin of maxilla, behind the outermost spine, deeply setose. Inner lobe rounded as usual and provided with two large setose spines.

Second maxilla (Fig. 4*d*) thin and plate-like, terminating distally in two lobes; outer lobe larger, in the form of a plate pointed toward inner end; inner lobe terminating in a dense mass of fine setae.

Mandible (Fig. 4*e*) provided with a double row of chitinous teeth, a setaceous membranous lappet, two "penicils" arising from the surface of the latter, a single "penicil" behind, followed at a little distance by the usual long curved "penicil."

Maxilliped (Fig. 4*f*) with the outer palp terminating in a large multispinous process, with about five spines (four in a cluster and one separate) on its inner side and a small spine on its outer side near the base; inner palp broad, its anterior margin fringed with fine setae, provided with one long spine in the middle, and three or more which are short and blunt, one at the inner margin and two or more at the outer. Two spines at the base of the outer palp—a long one near the inner margin and a shorter one about the middle.

Legs (Fig. 4*g*) long and slender, increasing in size from the first to the last, all markedly setaceous; carpus swollen in anterior pairs; last pair almost equally developed in the two sexes.

Opercular rami of none of the pleopods provided with air-cavities, those of the anterior pairs somewhat bilobed in both sexes. First pair in the male with the endopod slightly longer than the exopod, the former with the basal portion somewhat broad and provided with a powerful muscle, the distal half tapering and terminating in an acute point; the exopodite plate-like and sub-triangular, provided with a few spines along its outer margin. Second pleopod of male (Fig. 4*h*) with the exopodite sub-triangular, its apex bluntly rounded, provided with a few spines along its outer margin; the endopodite consisting of the usual two joints, a broad basal followed by a long and narrow distal joint, somewhat curved, ending in a fine point and extending considerably beyond the end of the exopodite.

Uropod (Fig. 4*j*) with the basal segment more or less rectangular, extending considerably beyond the end of the telson, setaceous and provided with a lateral expansion at the base of which the inner ramus articulates; the latter narrow, linear, not reaching up to the middle of the exopodite, provided with setae and terminating in a small tuft of long setea. Outer ramus of about the same length in the two sexes; considerably longer than the basal, thick at the base, tapering pos-

teriorly, ending in a blunt point and provided with hairs along the margins.

Colour almost white, with the lateral margins of the thorax and the abdomen of a slightly darker shade than the rest of the body. Colour a little less bleached in specimens from the outer part of the cave than in those procured in greater depths.

Length of the body reaching up to 10 mm.

The species does not occur in the outer parts of the cave, no specimens having been found nearer than 800 ft. from the entrance. The species commonly lives under stones, etc., near the water-edge; it is extraordinarily agile and specimens are difficult to procure. Specimens were obtained from the following points in the cave :—

800—1,200 ft. from the entrance. TYPES (C 552/1).
2,000—2,100 ,, ,, ,,
3,500—3,600 ,, ,, ,,

The structure of the mandible in the present species does not appear to be exactly in accord with the generic definition, for besides the single "penicil" behind the membranaceous lappet there are two others arising from the lappet itself. This condition, as pointed out above, is exactly like that described by Chilton in *Oniscus punctatus*. In all other characters, however, *P. dobakholi* does not show any material difference from other species of the genus.

The specific name of this Isopod refers to the Garo name of the cave, "Dobakhol," meaning literally a "bat-cave."

Philoscia sp.

One specimen, somewhat damaged, differs considerably from the rest, and possibly represents a new species. It is a female about 5 mm. long and was collected along with specimens of the preceding species from under stones in the tunnel between 800 to 1,200 ft.

The principal differences from the foregoing species are :—

1. The body is broader anteriorly, the breadth being half the length.
2. The lateral parts of the last three thoracic segments are better developed and are posteriorly acute; those of the last segment extend beyond the end of the third abdominal somite.
3. The first two abdominal somites are very small and their lateral margins are completely covered by the last thoracic somite.
4. The telson is more broadly pointed.
5. The inner ramus of the uropod is proportionately longer, extending considerably beyond the middle of the outer.

Besides, there are some minute differences in the mouth parts also, but I have not been able to study them in detail.

Cubaris cavernosus Collinge.

1916. *Cubaris cavernosus*, Collinge, *Rec. Ind. Mus.* XII, pp. 123, 124, pl. xvi, figs. 1-9.

I refer to this species, with a little doubt, a large number of specimens collected from the Siju Cave. I have not been able to examine

Collinge's specimens, collected from a cave near Cherrapunji, but from his figures and description I find that the Siju Cave specimens show a great resemblance to them. There are a few differences between the two, but in view of the great resemblance, I prefer, for the present at any rate, to regard them as belonging to Collinge's species.

Body oval, convex dorsally, with prominent rugose lateral patches on the thoracic segments; breadth somewhat greater than half the length.

Cephalon small, almost completely surrounded on sides by lateral parts of the first thoracic somite. Breadth less than half the length. Lateral lobes well developed, median lobe absent. Eyes small, but not found imperfect in any specimen.

First thoracic segment very large, remainder subequal. Lateral margins of first segment anteriorly surrounding the head, extending almost up to the anterior end and posteriorly drawn out. Lateral plates of first three segments somewhat curved upwards; those of segments 2—5 small, excavate. Lateral parts of last two somites large and only very slightly excavate. First two segments provided with the usual "notch and groove."

First two abdominal somites very small, their lateral parts completely covered by the seventh thoracic segment. Lateral parts of segments 2—5 large, backwardly directed. Telson as described by Collinge, but proportionately somewhat broader at the base.

Antennules and antennae as in Collinge's specimens, but the outer lobe of the first maxilla terminating in a different way, there being five stout curved spines and five (or even six in some specimens) smaller ones. Second maxilla thin, plate-like, terminating distally in two lobes; outer lobe large, fringed with setae on a portion of its margin; inner also setaceous, brush-like. Mandible of the usual shape, with a double row of chitinous teeth followed by a number of penicils. Maxilliped as described by Collinge, but with the outwardly directed spines at the base of the large multispinous process smaller in the Siju Cave specimens than in those figured by Collinge.

Thoracic legs stout, more strongly built in the male than in the female.

Opercular rami of the pleopods not provided with air-cavities. First two pleopods of the male having the usual shape; exopodite of the first pair sub-triangular, less than half the length of the endopodite; the latter with the basal half broad and provided with a strong muscle, distal half strongly curved, tapering acutely and pointing outwards. Second pleopod of male with the exopodite large, triangular and bluntly pointed at apex, both margins covered with fine setae; endopodite with the basal segment broad, distal long and narrow, drawn out into an acute point, strongly curved outwards and not reaching beyond the exopodite. Uropoda exactly as described by Collinge.

Colour lavender gray, with whitish patches arranged in two sub-median rows on the dorsal surface of the thorax. Colour lighter in larger specimens.

Length in my specimens hardly reaching 10 mm.

This is the commonest species of Isopod in the cave. A large number of specimens were found between 300 and 3,800 ft. from the entrance. The largest number of individuals was captured in the outer bat-chamber. In the inner parts of the cave specimens of this species were found living with *Philoscia dobakholi*. Specimens were collected from the following spots :—

300—450 ft. from the entrance.
800—1,200 ,, ,, ,,
2,000—2,100 ,, ,, ,,
3,500—3,600 ,, ,, ,,
3,800 ,, ,, ,,