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STUDIES ON ARTHROPODA

I.

BY

DR. H. J. HANSEN

WITH FOUR COPPER-PLATES

AT THE EXPENSE OF THE RASK-ØRSTED FUND



COPENHAGEN

GYLDENDALSKE BOGHANDEL
KJØBENHAVN, KRISTIANIA, LONDON, BERLIN

1921

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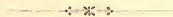
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THE PEDIPALPI, RICINULEI, AND OPILIONES (*exc. Op. Laniatores*)

collected by Mr. LEONARDO FEA
in tropical West Africa and adjacent Islands.

(With four Plates.)

SEVERAL years ago Dr. Raffaello Gestro, Director of the Museo Civico di Storia Naturale di Genova, asked me to work out the animals of the above-named orders gathered by that most excellent zoological collector Mr. Leonardo Fea, who during 1900—1902 spent his last years in exploring partly unhealthy countries in tropical West Africa, viz. Portuguese Guinea, Kameroun, and French Congo, and besides the islands of Fernando Póo, St. Thomé, Principe, and Annobon in the Gulf of Guinea; from this voyage Fea returned quite broken down to Italy and died shortly afterwards in April 1903. With pleasure I accepted Dr. Gestro's kind offer, as I expected to find most interesting animals among the material, but the main portion of the collection, viz. the Opiliones Laniatores, I found it necessary to hand over to a colleague, and before now I could not find the time necessary for the task.

The material to be dealt with in the present paper is in reality most valuable. It consists of eleven species, but with two exceptions all are new to science. Furthermore I found it necessary to establish three new genera, and two among these are even important. The collection comprises three species of Pedipalpi Amblypygi, and one of the forms, living in nests of white ants, is completely blind; furthermore two species of the tribe Tartarides, two species of *Cryptostemma* and four species of Opiliones, but two of these belong to the small

sub-order Op. Cyphophthalmi. As Tartarides, Ricinulei (*Cryptostemma*) and Op. Cyphophthalmi are scarce even in the largest Museums of the world, it is easily seen that the collection is important out of all proportion to the somewhat low number of species; the presence of an unknown kind of larval stage of the Ricinulei highly increases its value. Before concluding these remarks, I may beg Dr. R. Gestro to accept my sincere thanks for offering me the material and for his patience as to the long delay.

ORDER PEDIPALPI

A. Sub-order Amblypygi.

In his monograph (Revision der Tarentuliden Fabr., 1895) K. Kraepelin accepted three sub-families, and in 1902 R. I. Pocock elevated them to the rank of families. Only one of these families, viz. the Phrynidae, was hitherto known from Africa, and a single well-known form is represented in the collection. But this contains besides two species of the family Charontidae, which hitherto was known only from the Indo-Australian region and the Galapagos Islands.

It may be inserted that I am inclined to consider the second of the two long joints in the mandibular palps as corresponding to patella plus tibia in Araneae and Pedipalpi Uropygi; in the descriptions I can therefore follow Kraepelin who named it tibia.

Titanodamon medius Herbst.

Kraepelin mentioned three varieties, viz. *typicus* Kraep., *tibialis* Simon, and *Johnstoni* Pocock; the two last-named varieties had been established as separate species by the authors

named, but Kraepelin was certainly right in withdrawing them. Var. *typicus* is said to occur from Senegal to the estuary of the Niger, var. *tibialis* especially in the Congo region, and var. *Johnstoni* in the area between those of the two other forms. The material comprises specimens belonging to var. *typicus* and to var. *Johnstoni*, but animals from the same locality vary not only much according to age in the length of the proximal one of the three long distal spiniform processes on the upper margin of the tibia, but between the numerous specimens from the Isl. of St. Thomé, all according to the shape of the frontal process belonging to var. *typicus*, a few specimens show a transition between *typicus* and *Johnstoni* as to the setæ on the inner side of the antennæ.

Occurrence. — Specimens of var. *typicus* are to hand from the following places: Bolama, Portuguese Guinea (near lat. 12° N.), June—Dec. 1899, 6 specimens; and Isl. of St. Thomé, at Ribeira Palma, 0—300 m above the level of the sea, Juli—August 1900, 17 specimens, and 2 small specimens in June 1900 at the capital of the island.

Specimens of var. *Johnstoni* were taken at two localities, viz. Basilé on Fernando Póo, 400—600 m above the level of the sea, August—September 1901, 1 specimen, and N'Kogo, French Congo, December 1902, 1 specimen.

Charinus africanus n. sp.

Pl. I, figs. 1 a—1 c.

This species agrees completely with the characters of the genus *Charinus* in Kraepelin's analytical key excepting as to one feature, viz. that the first tarsal joint is conspicuously longer than the four others combined.

Cephalothorax in adult specimens considerably broader than long, with six thin spines at the rounded front margin. The distance between each ocular tubercle and the lateral

margin nearly or scarcely twice as long as the transverse diameter of the tubercle.

Interior prehensile margin of the basal joint of the antennæ with four teeth, and the most distal tooth bifid, while the exterior margin has no tooth.

Palps about as long as the body. Trochanter with two small processes on the anterior margin (in fig. 1 a the proximal spine is overlapped, not visible); the robust process on the lower side with a number of strong setæ on the inner and lower surface. Femur in the adults at least a little shorter than the cephalothorax; its upper front margin proximally with two small, conical, setiferous tubercles, more distally three or four processes, the first moderately long, the others decreasing in length, and the fourth, if present, quite short; the lower front margin (fig. 1 a) with at least three processes decreasing in length from the first to the third, and the first which originates near the base, is long; sometimes a small or very small fourth process is found. Tibia on the upper margin with four processes (fig. 1 b), the second and especially the third very long, strong, with a setiferous protuberance or rather an offset on the proximal side somewhat from the base; the first process is only about half as long as the next, but longer than the fourth; frequently a setiferous conical protuberance is found before the first real process; the lower margin (fig. 1 a) on the distal half with two moderately long processes, the proximal shorter than the distal, and this margin has besides three or four quite small setiferous tubercles. First tarsal joint has on the upper margin (fig. 1 c, *u*) near the middle two processes, the second considerably to very much longer than the first, while the lower margin has a single moderately long, porrected process a little before the end. Second tarsal joint (fig. 1 c) with two slender processes on the upper margin, the distal from con-

siderably longer than to twice as long as the first; the lower margin without any process.

The three posterior pairs of legs have the metatarsus distinctly longer than the tarsus; first tarsal joint about one-fourth as long again as the four other joints combined.

The dorsal surface of the cephalothorax in the adult somewhat dark reddish-brown, with the impressions blackish, while the abdomen is brownish-grey with the muscular impressions dark and very conspicuous. Antennæ, palps, and femora of the legs somewhat lighter than cephalothorax; legs without yellowish or light rings.

Length of the body of a large specimen 8.4 mm, cephalothorax 3 mm, palp stretched out 8.8 mm (claw included), second leg (coxa not included) 14.5 mm.

Remarks. — *C. africanus* is allied to *C. australianus* L. Koch, but is instantly distinguished in having the first tarsal joint in the three posterior pairs of legs very conspicuously longer than the four other joints combined. Furthermore adult specimens of *C. australianus* have, according to Kraepelin, a higher number of processes on both margins of the tibia of the palps than is found in *C. africanus*.

Occurrence. — Taken on three of the Islands in the Gulf of Guinea: Annobon, St. Thomé and Principe. On Annobon 6 specimens were taken in May 1902 in an altitude of 400—500 m, and 1 specimen in April in 0—500 m. On St. Thomé 3 specimens were gathered in December 1900 at Água Izé, altitude 400—700 m, and 11 specimens in September—October 1900 at Visto Alegre, altitude 200—300 m. On Principe 7 specimens were secured in Jan.—March 1901 at Roca Infante Don Henrique, altitude 100—300 m. — Adult specimens from St. Thomé are a little smaller than those from the two other islands.

Paracharon n. gen.

Cephalothorax not much broader than long, anteriorly somewhat produced, with a rather short, transverse, anterior margin. Eyes and ocular tubercles completely wanting (fig. 2 a). First sternum is a light transverse strip more firmly chitinized than the membrane at its front margin, but instead of a sternal labium only a tiny granule with a small vertical seta is seen at the middle of the sternum. Each of the two following sterna have a rather slender, subcylindrical process projecting nearly vertically downward, higher than thick, and with some short, brown setæ on the rounded distal part. — Second abdominal sternite simple, as its posterior part is not marked off or produced. — Palps considerably shorter than the body, built as in the Charontidæ; first tarsal joint (fig. 2 d) with two spiniform processes on each margin and the distal processes much longer than the proximal; second tarsal joint with three processes on the upper margin, and the claw marked off but not movable. Walking legs as in the Charontidæ, excepting that the tibia of fourth pair consists only of two subjoints.

Remarks. — This most interesting genus differs from all other genera of the suborder in having no eyes and no sternal labium. It shows, however, close relationship to the Charontidæ in all other features, excepting that the fourth pair of tibiæ have only a single secondary articulation.

It may be noted that I have looked in vain for sensory hairs on the places of the eyes. But the normal long tactile hairs on the walking legs and the peculiar small, club-shaped sensory hairs on the distal tarsal joints of the first pair of legs exist, though less numerous, as in the large form *Tarentula reniformis* L. (*Phrynichus nigrimanus* C. L. Koch) (see H. J. Hansen: Organs and Characters in different Orders of Arach-

nids, in Entom. Meddel. Kjøbenhavn, Vol. IV, 1893—94, p. 154—156).

Only one species is known.

Paracharon caecus n. sp.

Pl. I, figs. 2 a—2 c.

Cephalothorax (fig. 2 a) only about one-eighth as broad again as long, considerably vaulted, with the radiating impressions partly deep; the antero-lateral margin is a little concave, the front margin transverse, rather short, with about six minute, very short spines.

Palps scarcely twice as long as the cephalothorax. Trochanter with two small processes on the anterior margin (fig. 2 a), while the well developed process on the lower side (fig. 2 b) has five or six triangular, setiferous teeth on the inner margin. Femur not fully half as long as the cephalothorax (fig. 2 a); its upper front margin has near the middle two somewhat small processes; the lower margin has three to five processes, the first somewhat long (fig. 2 b), the second distinctly or considerably longer than the first, the others small. Tibia has on the upper margin (fig. 2 c) three well developed processes, the second process considerably longer than the first or the third, and besides generally two small teeth placed respectively before the first process and between first and second process; the lower margin (fig. 2 b) has three processes, the second very long and the others rather short, and besides frequently a minute tooth before the first and another before the second process. First tarsal joint large and only somewhat shorter than the tibia; each margin (figs. 2 b and 2 d) has two processes, the distal long or very long and much longer than the proximal, and besides a distinct or rudimentary tooth is frequently seen on the lower margin just before the proximal process, and sometimes a rudimentary tooth before the distal

process. Second tarsal joint (figs. 2 b and 2 d) has along the upper margin (*u*) three processes increasing in length from the first to the third which is moderately long; the lower margin has only a single moderately short process.

In second and third pairs of legs the metatarsus is about as long as the tarsus, and first tarsal joint is somewhat longer than the four distal joints combined. Fourth pair of legs (fig. 2 e) have the tibia divided by a single secondary articulation into two subjoints, the first more than three times as long as the second; metatarsus somewhat longer than in the preceding pairs of legs and conspicuously longer than the tarsus.

Upper surface of cephalothorax in the adult dark yellowish brown, with the deep portions of the impressions dark brown; abdomen above light greyish with a somewhat yellowish tint. Antennæ, palps, and femora of the legs nearly as, or a little lighter than, the cephalothorax; the legs without light rings.

Length of the body of a large specimen 7.3 mm, cephalothorax 2.8 mm, palp stretched out (claw included) 5 mm, second leg (coxa not included) 8.6 mm.

Remarks. — The specimens have been found in nests of *Termes* (genus and species not noted); only a single specimen has no indication on this topic on the label.

Occurrence. — Portuguese Guinea (near lat. 12° N.) at two places: Bolama, June—December 1899, 1 spec.; Rio Casine, Jan.—Febr. 1900, 1 spec., and April 1900, 15 spec.

B. Sub-order Uropygi.

This sub-order comprises two tribes, Oxopoei and Tartarides, which differ in several important features. No specimen of the Oxopoei was found among the material, but it contains a number of specimens of the Tartarides.

Tribe Tartarides.

In H. J. Hansen and William Sørensen: The Tartarides. A Tribe of the Order Pedipalpi (Arkiv för Zoologi utgif. af Svenska Vet. Akad. Stockholm, Band 2, Nr. 8, 1905) I described 15 species of this most interesting group, mentioned a Californian species established by Cook but unknown to me, and pointed that *Artacarus liberiensis* Cook must be considered a nomen nudum. Since 1905 Randall Jackson has described (1907) an interesting form taken in the Botanic Gardens, Kew; in three small papers (1911) F. H. Gravely established no less than 2 species from Ceylon and 4 from India; K. Kraepelin (1911) established a new species from Formosa; Hirst (1913) a species from the Seychelles; finally H. J. Hansen (1910) a new species from Kilimandjaro. Thus in all 26 species have been really described, but of these only 2, viz. *Schizomus montanus* H. J. H. and *Trithyreus africanus* H. J. H., are of African origin. And it may be added that both these species have been established on female specimens which certainly or scarcely had not arrived at sexual maturity, and consequently the knowledge must be somewhat imperfect. The Fea collection contains adult specimens of both sexes of two new species, and this material is therefore very valuable, though the forms do not exhibit peculiar features expanding the general conception of the type.

Trithyreus parvus n. sp.

Pl. I, figs. 3 a—3 k.

Male.

Head with an oblong, rounded, badly limited paler eyespot on each side, but without any cornea. Cephalic sternum a little longer than broad. Second thoracic tergite with a narrow and whitish median strip of thinner skin.

Palps (figs. 3 a and 3 b) somewhat slender, about two-thirds as long as the body. Trochanter has the lower front part some-

what produced, with the terminal margin straight, the corner angular, and this angle measures 90° — 95° . Femur uncommonly slender, more than two and a half times as long as deep, with the lower margin nearly straight though slightly sinuate, but without any protruding angle towards the base. Patella a little less than three times as long as deep. Tibia slightly more than three times as long as deep. Tarsus unusually long, as its upper margin is as long as the lower margin of the tibia; claw only one-fourth as long as the upper margin of the tarsus.

First pair of legs (fig. 3 a) slender, somewhat more than half as long again as the body. Coxæ terminate scarcely before the outer angle of the mandibles (maxillæ auct.). Femur a little longer than tibia. Foot a little shorter than tibia, about nine and a half times as long as deep (fig. 3 d), deepest near the end of metatarsus; second joint of the metatarsus almost as long as the sum of the four proximal joints plus half of the fifth joint of the tarsus; terminal joint a little longer than fourth and fifth tarsal joints combined, and a little more than half as long as the whole metatarsus.

Fourth legs somewhat longer than the body; femur scarcely two and one-third times as long as deep (fig. 3 f).

Three posterior abdominal segments telescoped and very considerably thicker (fig. 3 i) than in the other sex; last segment without any protuberant part above the insertion of the flagellum.

Flagellum (figs. 3 h and 3 i) of very moderate size, somewhat less than twice as long as broad, but almost two and a half times as long as deep, consequently its thickened part considerably depressed. The stalk rather compressed, seen from above a little more than one-third as long as the main piece. Seen from above, the main piece is only one-fourth as long again as broad, broadest at the middle, with the proximal half of the lateral margins rather convex, and the distal half to a little

from the end conspicuously concave; the end is angular. Seen from the side (fig. 3 i) the lower margin of the whole flagellum is shaped as a line somewhat curved or convex at the middle, while the upper margin is incurved considerably before the end. The flagellum has several pairs of long or very long spiniform setæ distributed on the sides, at the end and on the lower surface, while the upper side has only two erect shorter setæ far from one another in the median line.

The walking legs, the upper surface of abdomen, and the posterior part of the dorsal side of cephalothorax are more or less olive-green with a reddish or light reddish tint; front part of the head, antennæ and palps reddish; the lower surface of the body lighter.

Body without flagellum 2.64 mm., palp 1.75 mm., first leg 4.1 mm., fourth leg 2.9 mm.

Female.

It agrees with the male in many particulars, but differs in several features.

Palps (fig. 3 c) a little more robust and proportionately shorter than in the male, being only about half as long as the body. Trochanter has not the lower distal part produced, and the corner is a rather obtuse angle measuring about 110° . Femur considerably deeper than in the male, scarcely twice as long as deep, and the lower margin is angularly bent a little from the base; the tip of this angle is a little nearer to the proximal than to the distal end of the upper margin of the joint. Patella and tibia slightly thicker than in the male, while the tarsus is conspicuously shorter than in that sex, and the claw is somewhat more than one-third as long as the upper margin of the tarsus.

First pair of legs slender, slightly longer than the body. Coxæ terminate a little before the outer angle of the mandibles.

Femur distinctly longer than the tibia. Foot a little shorter than tibia, almost ten times as long as deep (fig. 3 e); second joint of metatarsus slightly longer than the four following joints combined; terminal joint conspicuously more than half as long as the whole metatarsus.

Fourth legs considerably shorter than the body; femur about twice as long as deep (fig. 3 g).

Three posterior abdominal segments (fig. 3 k) much more slender than in the male.

Flagellum (fig. 3 k) a little or considerably shorter than in the male, nearly four times as long as deep, three-jointed, but the first articulation is more or less obsolete; the terminal joint a little more than two-thirds of the whole length.

The largest female which has been taken as type, has the body 3.3 mm. long, the palp is 1.63 mm., first leg 3.4 mm., fourth leg 2.8 mm. Other females, which seem to be adult, are only about as long as the male, but the relative length between body, first leg, etc. about as in the large female.

Colour and other characters not mentioned in this description nearly as in the male.

Remarks. — As usual the palps and the flagellum in both sexes afford the best characters. *T. parvus* is easily distinguished from *T. africanus* H. J. H. (1905) in having the last tarsal joint of first legs considerably shorter in proportion to more proximal joints, in the shape of the femur of the palps, etc. The differences between *T. parvus* and the next species are pointed out below.

Occurrence. — Ten specimens, among them two adult males, were collected on the Island of St. Thomé at Vista Alegre, altitude 200—300 m., October 9, 1900. An immature female was secured at Punta Frailes, Isl. of Fernando Póo, Oct. 1901.

Trithyreus brevicauda n. sp.

Pl. I, figs. 4 a—4 d; Pl. II, figs. 1 a—1 g.

Male.

Head without any distinct eye-spot on the sides. Cephalic sternum much longer than broad. Second thoracic tergite with a sharp median suture.

Palps (figs. 1 a and 1 b) moderately robust, somewhat less than half as long as the body. Trochanter with the lower distal part slightly produced, the corner acute but the angle measuring about 110° . Femur a little less than twice as long as deep, subtriangular, but the median part of the lower margin convex without any angle, and its deepest point a little longer from the proximal than from the distal end of the upper margin. Patella a little less than two and a half times as long as deep; tibia slightly more than three times as long as deep. Tarsus not elongate; its upper margin a little more than half as long as that of the tibia. Claw distinctly less than half as long as the upper margin of the tarsus.

First pair of legs (fig. 1 a) moderately robust, somewhat longer than the body. Coxæ terminate somewhat before the outer angle of the mandibles. Femur somewhat longer than the tibia. Foot as long as the tibia, between eight and a half times and nine times as long as deep (fig. 1 e), deepest towards the end of the metatarsus; second joint of metatarsus nearly as long as the sum of the four proximal joints and half of the fifth joint of the tarsus; terminal joint slightly longer than fourth and fifth tarsal joints combined, and distinctly more than half as long as the whole metatarsus.

Fourth legs a little shorter than the body. Femur two and one-third times as long as deep (fig. 4 b).

Three posterior abdominal segments telescoped (fig. 1 g) and somewhat thicker than in the female; last segment without any protruding part above the insertion of the flagellum.

Flagellum (figs. 1 f and 1 g) uncommonly small, a little more than twice as long as broad, but almost three times as long as deep, consequently its thickened part considerably depressed. The stalk only a little deeper than broad, seen from above (fig. 1 f) scarcely one-third as long as the main piece, which is oblong-ovate, not quite half as long again as broad, with the lateral margins moderately convex and the end very obtuse, rounded. Seen from the side (fig. 1 g) the lower margin of the flagellum has its shorter proximal part feebly concave and the remainder somewhat convex; the upper margin has the proximal half somewhat sinuate, the distal somewhat concave and nearly angularly bent at the middle. Several of the spiniform setæ lost in the single specimen; the upper surface has beyond the middle a pair of setæ and more proximally a seta in the median line.

Colour nearly as in *T. parvus*, though a little more brownish.

Length of the body 3.15 mm., palps 1.4 mm., first leg. 3.5 mm., fourth leg 3.0 mm.

Female.

Similar to the male in most respects; the sexual differences are less numerous than in most species.

Palps (figs. 1 d) differ feebly from those in the male. Trochanter has the lower distal corner rounded and not angular, but the angle measures as in the male about 110° .

First pair of legs (fig. 1 c) as long as the body. The coxæ terminate distinctly longer from the outer angle of the mandibles than in the male. Foot slightly longer than tibia, differing from that in the male in having the terminal joint proportionately a little longer (fig. 4 a), somewhat longer than fifth and fourth joints combined, and considerably more than half as long as the whole metatarsus.

Fourth legs considerably shorter than the body; femur (fig. 4 c) a little shorter than in the male, a little more than twice as long as deep.

Three posterior abdominal segments somewhat less deep than in the male.

Flagellum (fig. 4 d) even a little longer than in the male, scarcely five times as long as deep, three-jointed; third joint scarcely twice as long as the two proximal joints combined.

Length of the body 3.15 mm., palps 1.40 mm., first leg 3.15 mm., fourth leg 2.77 mm.

Remarks. — *T. brevicauda* is closely allied to *T. africanus* H. J. H., which was established (in 1905) on a probably immature female from Freetown. But the specimen of *T. africanus*, which was 2.9 mm. long, thus only a little smaller than the adults of *T. brevicauda*, differs from these in having the claw of the palps conspicuously shorter, and besides especially in the foot which has the terminal joint proportionately much longer than *T. brevicauda*, and though this joint is proportionately longer in immature than in adult specimens, the difference between the relative length of this joint in *T. africanus* and *T. brevicauda* is so large that my adult specimens cannot belong to *T. africanus*. It may be added that the foot of *T. africanus* is nine times as long as deep, thus nearly more slender than those in *T. brevicauda*, but in immature specimens the foot is less slender than in adults of the same species. — The small flagellum of the male differs very considerably from that organ in males of other species hitherto known.

Occurrence. — Bolama in Portuguese Guinea (Kerry coast), December 11, 1899; 3 adult specimens (1 ♂, 2 ♀).

ORDER RICINULEI

The main paper on this small but most interesting order is: *H. J. Hansen and W. Sørensen: On Two Orders of Arachnida. Opiliones, especially the suborder Cyphophthalmi, and Ricinulei, namely the family Cryptostemmatoidæ. Cambridge. At the University Press. 1904 (4to).* — Since its publication nothing, as far as I know, has been added to our knowledge of the recent forms. But a curious attempt by Prof. Fr. Dahl (Berlin) may be briefly mentioned. In 1911 he published a small treatise: *Die Hörhaare (Trichobothrien) und das System der Spinnentiere (Zool. Anzeiger Vol. XXXVII, p. 522—532).* He ascribes a high systematic value to the existence and distribution or non-existence in the various orders of Arachnida of that kind of sensory hairs which he names "auditory hairs"; besides, without any real discussion and without pointing out any feature hitherto overlooked in the orders Pedipalpi, Palpigradi, Ricinulei, Opiliones, and Acari, he refers the Palpigradi to the Pedipalpi, the Ricinulei to the Opiliones, and the suborder Cyphophthalmi from the Opiliones to the Acari. That such classification is only of the retrograde kind is rather evident; it is scarcely necessary to prove its futility by detailed enumerations of structural features and a lengthy discussion of their relative value in the orders and suborders in question. In a paper published in 1917¹⁾. I have dealt with the so-called "auditory hairs" in Arachnida and in the two other classes of terrestrial Arthropoda. — On the palæozoic forms of the order Ricinulei important contributions have been published by

¹⁾ H. J. Hansen: On the Trichobothria ("auditory hairs") in Arachnida, Myriopoda, and Insecta, with a summary of the external sensory organs in Arachnida (Entomologisk Tidskrift utg. av Entomol. Föreningen i Stockholm. Årg. 38, 1917, p. 240—259.

R. I. Pocock (1911) and especially by A. Petrunkevitch (1913). It is remarkable that as to the palæozoic genus *Polyochera* Scudder, which seems to be rather allied to recent forms, the last-named author mentions only one generic character, viz. that "tarsus of second leg fused with metatarsus, forming one joint", but this character is important, as in the recent forms the second pair of legs has in the adult a separate, well developed metatarsus, and the tarsus five-jointed.

The material collected by Fea comprises two species, one among them new, while the other species is *Cryptostemma crassipalpe* Hans. & Sör, which was established on immature specimens, but Fea has secured adult specimens of both sexes. Of the new form a large material is to hand, which enables me to add a little on a couple of points to the description in Hansen & Sörensen's work, and besides to show that a kind of metamorphosis exists in this order, as I have two specimens of a larval stage with only three pairs of walking legs.

In the paper mentioned the spiracles and the tracheæ in the immature *Cryptostemma* was described (p. 131—132). I have dissected an adult male of *C. Fea* n. sp. and found a similar structure, so that only one single particular may be mentioned. On the crescent-shaped spiracles we wrote: "The walls, particularly near the opening, are furnished with short, extremely thick, slightly branching hairs . . . which almost have the character of processes, and at least in part are free of each other". In the adult I have found that both the convex and the concave margin of the crescent-shaped spiracle have a very close layer of processes which are very oblong, and each with a number of moderately short, acute spines in every direction. Each layer has a certain thickness, as it is formed by a few rows of processes. The processes are on both margins shorter towards both ends of the spiracle, and when the processes of the two layers reach each other with their ends, they constitute with their

lateral thorns a kind of sieve for the air. The processes are light brownish.

In 1904 we showed that in the female of the large form *Cryptostemma Afzelii* Thor. the sternites of first and second abdominal segments are freely movable, crescent-shaped, with their concave margins turning against each other, and they surround together the genital aperture; both sternites are only visible, when the abdomen is bent much upwards. In *C. Feæ* n. sp. I find the same structure, but the sternites are a little less robust. In this species — and probably in all other forms of the order — the genital aperture is in the male much smaller than in the female; the sternite of second segment is very thin and semi-circular or in reality curved so much, that it occupies about three-fifths of a circle; the sternite of first segment is produced downwards as a freely protruding, triangular plate about as long as broad and with the end subacute. The same plate is also found in the adult male of *C. crassipalpe*. An internal copulatory organ is, as might be expected, completely wanting, but according to my dissection of a single male, the inner sexual organs and the alimentary canal can scarcely be made out with certainty without fresh material or at least the sacrifice of several well preserved specimens of both sexes.

The Larva. — The body is about 2.3 mm. long, second leg 3.3 mm. In general aspect the body of the larva is in the main similar to half-grown specimens, differing in being comparatively a little broader, with the grooves on cephalothorax partly feebly developed, partly wanting, and without grooves on the cucullus, while the tergites of the abdomen and the granulation are nearly as in postlarval younger stages. But the larva has only three pairs of walking legs, as the fourth pair is completely wanting (pl. III, fig. 1 g). That it is the fourth pair which is wanting is seen from the fact, that the coxæ of first, second, and third pairs

are immovably united as in the adults, while in the adults the coxæ of fourth pair are movable. Furthermore the larva differs from postlarval stages in the tarsi of second and third pairs of legs. The tarsi of third pair (pl. III, fig. 1 i) have only two joints, the second not fully twice as long as the first, but otherwise not showing any peculiarity worth mentioning. But the tarsi of second pair (pl. III, fig. 1 h) are interesting. Each of them has only two joints, both very large, somewhat compressed and very deep, much deeper than the metatarsus; the proximal joint is more than one-third as long as the metatarsus, only a little longer and deeper than the second, which has the claws and even the normal subdistal sensory hair (s.) normally developed. — The interesting fact that the Ricinulei thus possess a larval stage with only three pairs of walking legs removes the order further from all other orders of Arachnida except the Acari, but in nearly all other structural features hitherto known the Ricinulei have no affinity to the Acari.

Cryptostemma crassipalpe Hans. & Sör.

Pl. II, figs. 2 a—2 h.

This species was established on two immature specimens, one among them not far from full-grown, with the full number of joints in the tarsi, but the animal was light-coloured, and the tergites of the three large abdominal segments were rather removed from each other. The material collected by Fea comprises two immature specimens and five adult animals of both sexes. It may be convenient to begin with the young specimens.

The largest of the immature specimens is somewhat smaller than the type, as its body is only 4.2 mm. long, while the type was 4.8 mm. It agrees well with the description and figures quoted, excepting that the femoral part of the palps is only half as thick as long, while in the type it was distinctly more than half as thick as long, but this difference is in other forms

due to age. When viewed obliquely there may be observed a faint vestige of the sublateral impression on the cucullus, while in the type this feature was not perceived.

Adult specimens. — Body and legs brown or dark brown and on some places reddish; the granules which are extremely numerous, especially on the body, are in immature specimens purple and therefore very conspicuous in contradistinction to the yellowish skin, but in the adults they are not distinctly marked off by colour from the skin; when the adult animal is dried it changes its aspect, as the exceedingly numerous scales are very light, being somewhat slate-whitish with a yellowish tint, and consequently the animal looks rather clayey, darkest on the median portion of the ventral surface where the clothing is less dense.

The cephalothorax has the same outline and dorsal grooves as the subadult type, but it differs in a curious feature. A median area, nearly triangular with the sides convex, is raised between the end of the median groove and the posterior margin as a moderately large, rounded protuberance or rather low tubercle badly marked off, which in the male is directed mainly upwards, in the female upwards and considerably backwards, so that in the latter sex the cephalothorax seen from above (fig. 2 a) has the median part of its posterior margin very conspicuously convex.

The cucullus (fig. 2 b) seems to be slightly broader in proportion to length than in young specimens, and a sublateral oblong impression is distinct, but real grooves are not developed.

The palps (fig. 2 c) have the femoral part a little or conspicuously more than half as thick as long. The tibial part is adorned with numerous granules on more than its distal two-thirds, and these granules are oblong and rather coarse on the most distal third. — (As usual in adults the thick connecting skin between the large abdominal tergites has nearly disappeared).

Sexual differences are found in the above-named protuberance on the cephalothorax and in the three anterior pairs of legs. First legs are scarcely or distinctly thicker in the male (fig. 2 d), than in the female (fig. 2 e), but at least the shape of the metatarsus is rather different in the two sexes; in the female the metatarsus is moderately slender, with the same thickness in its whole length, and its lower, inner margin is feebly convex; in the male the metatarsus is thicker, increases a little in thickness from the base to a little from the end, and the distal two-thirds of its inner margin is much more convex than in the female. Second legs are somewhat varying, as they may be similar in both sexes or a little stouter in the male.

The copulatory organs (fig. 2 g) on third pair of legs on the whole similar to those in *C. Westermanni* Guér. and *C. Sjöstedtii* Hans. & Sör.; of course the movable process of first tarsal joint has a shape of its own and affords as usual excellent specific characters. It may be mentioned that the metatarsus from in front (fig. 2 g, b) is somewhat more than twice as long as thick; its movable process has the most distal slender part curved very considerably backwards. First tarsal joint (*d*) is uncommonly long, being, seen from below, only somewhat shorter than second and very much longer than the third, which is somewhat shorter than the fourth. The second tarsal joint (*e*) has the distal triangular process (e^1) of the front wall rather small, while the lamina cyathiformis (e^2), is high, and consequently the upper end of its wall is more than twice as far from the distal lower end of the joint than is the case with the tip of the process from the front wall. The movable process (d^1-d^2) of first joint has the distal segment about twice as long as the proximal; the distal segment seen from the outer side (fig. 2 h) is rather narrow, the proximal process from its front margin is situated considerably before the middle, and is somewhat short, oblong-triangular, and very acute;

the distal part of second segment is produced into three processes, but the two drawings (figs. 2 g and 2 h) may convey a sufficient idea of the curious shape of the whole part.

In the male the body is 4.4 mm. long, second leg 7 mm.; in the female the body is 4.7 mm. long, second leg 6.9 mm.

Remarks. — *C. crassipalpe* is easily separated from the other species hitherto known of the genus in having the body and most of the legs covered with very broad scales, which are not much longer than broad or almost as broad as long.

Occurrence. — Island of Fernando Póo, at two places: Musola, altitude 400—500 m., January 1902, 2 males, 3 females, 1 immature specimen; Basilé, altitude 400—600 m., August—September 1901, 1 young specimen.

Distribution. The specimens described by Hausen and Sörensen were from Kameroun, the part of the continent opposite to the Isl. of Fernando Póo.

Cryptostemma Feæ n. sp.

Pl. II, figs. 3 a—3 c; Pl. III, figs. 1 a—1 i.

A. Adult Female.

Closely allied to *C. Afzelii* Thorell as described by Hansen and Sörensen, so that it may be advisable to lay special stress on the differences.

Cephalothorax slightly longer than broad. Its surface is adorned with numerous moderately large granules conspicuously lower than high and of a special structure, as their outline is circular, the upper surface very moderately arched, marked off from the sides by a sharp outline, very finely striated, and besides very dark coloured, brownish black, while the sides of the granules are greyish; between the granules a number of feebly clavate hairs somewhat or considerably longer than the height of the granules; the whole adornment of the surface differs from that in *C. Afzelii* in having the granules

conspicuously less closely set and the hairs longer. The lateral margin of the cephalothorax is considerably less concave before the submedian angle than in *C. Afzelii*, and the angle mentioned is less protruding. The median groove is well developed, reaches to or nearly to the front margin, is posteriorly deep, and at its end is seen a short transverse groove. The marginal groove — along the anterior half of each lateral margin — is well developed; as in *C. Afzelii* two grooves forming a right angle with one another are seen on the area between the median groove and the submedian angle of the lateral margin.

Cucullus (fig. 3 a) as long as broad at the base, and beyond the middle half as broad again as at the base; the submarginal grooves moderately developed. The surface is adorned with numerous granules, which are smaller but proportionately higher than on the cephalothorax and otherwise of the same structure; between them are found a number of minute granules and besides hairs; these hairs are considerably longer than the height of the larger granules, subclavate, and towards the front (lower) margin of the cucullus the hairs are longer, cylindrical, at the margin still longer and acute. — The cucullus differs from that in *C. Afzelii* in having the granules less closely set.

Abdomen above with granules and hairs quite as cephalothorax; from the middle to the posterior end the granules are gradually a little smaller and more numerous. On the ventral side the granules are very numerous and quite small and low, but somewhat larger towards the posterior end.

The antennæ (fig. 3 b) as in *C. Afzelii* with five teeth on the distal posterior margin of first joint, but they differ in being longer than broad; the inner margin of second joint is more armed than in *C. Afzelii*, as it possesses a row of about eight rounded teeth.

The palps (fig. 1 a) have the trochanterical part on the front side set with numerous small granules, which are much larger

near the lower margin. The femoral part a little more than twice as long as thick, especially on the anterior side with a good number of small granules and numerous hairs, most of them moderately short, but no impressed points are found. The tibial part is slightly or a little thicker somewhat from the base than at the middle, but towards the end it is feebly or very feebly thickened, conspicuously less so than in *C. Afzelii*; its anterior side, excepting a proximal part, is granulated, and the granules are much larger on the distal third, largest and besides oblong towards the end; on the proximal major part the hairs are as on the preceding joints, while several of the distal hairs are long and simple.

The legs have their joints, excepting the tarsi, adorned with numerous granules of the same quality as those on the surface of cephalothorax, but they are on the whole proportionately a little higher, less broad, with the terminal dark, striated area much smaller (fig. 3 c); the hairs as on cephalothorax; the adornment differs from that in *C. Afzelii* in having the granules less dense and the hairs somewhat longer. All femora with a conspicuous longitudinal furrow above¹). Tibia of second pair with a distinct, that of fourth pair with a less distinct longitudinal dorsal furrow, which is wanting on first and third tibia; first tibia twice as long as thick. Fourth joint of second tarsus half as long again as the fifth, which is distinctly longer than third joint.

Colour dark reddish brown, with the limbs a little lighter, more reddish. Some ten specimens probably captured a short time after the last mould, have the body lighter reddish brown and the limbs more or less ferruginous.

Length of the body 6.4 mm., of second leg 8.5 mm.

¹) Here I may correct a misscript in Hansen and Sørensen's paper. In the description itself of *C. Afzelii* the femora are correctly stated to have a longitudinal dorsal furrow, but in the diagnosis is said: "femora supra non sulcata" and the word "non" must be cancelled.

Male.

Similar to the females in most features, but differs strongly in thickness and shape of the two anterior pairs of legs. First legs (fig. 1 b) are on the whole stouter than in the female (fig. 1 c); tibia and metatarsus are much thicker and differently shaped. Tibia only half as long again as thick (in the female twice as long as thick), thickened below but without any process; metatarsus widened below, with the inferior margin conspicuously more convex than in the female. — Second legs (fig. 1 b) extremely altered; femur always enormously thickened upwards and downwards, but yet showing considerable individual variation; in the specimen figured the femur is a little less than twice as long as deep at the middle (in the female (fig. 1 c) about four times as long as deep), but in one specimen it is scarcely two-thirds as long again as deep; the femur has therefore both the upper and the lower margin very convex but it is much compressed; besides the granules on the major part of the anterior and the posterior side are feebly developed, and in some specimens the dorsal longitudinal furrow has disappeared, while it is distinct in other specimens. Tibia on the lower side near the base produced into a long and thick, obtuse, a little curved process directed downwards and forwards, and granulated as the remainder of the joint. Metatarsus has frequently a short portion near the middle of the lower margin distinctly produced as an oblong, low protuberance, but in other specimens this expansion is very feeble.

The copulatory organ, excepting its movable process on first tarsal joint, agrees so closely with that of *C. Karschii* Hans. & Sör. described and figured in 1904, that it may be omitted here. As usual the movable process mentioned has a shape of its own, affording specific characters. Its second segment is more than twice as long as the first (fig. 1 e); seen from the outer side (fig. 1 f) its major distal part is lamellar and rather

broad; the proximal process at its front margin protrudes before the middle of the segment, is long, broad at the base and tapers towards the broadly obtuse end. The most distal part of the segment has a moderately long, curved, distally slender process and besides a pair of short, triangular processes; the complicated shape may be judged from the two figures.

Length of the body 6.6 mm., of second leg 10 mm.

Immature Specimens.

Specimens not far from full-grown differ as usual from the adult female in the colour; the cephalothorax is yellowish ferruginous, the abdomen greyish and the legs brownish yellow; furthermore, in the palps the femoral part is more slender, the tibial part has the subbasal portion conspicuously thicker than the middle, and it increases scarcely in thickness from the middle to the end.

A younger specimen, which has only four joints in the tarsi of fourth pair but the full number in the other pairs, is 4.1 mm. long, with second leg 5.6 mm.; it has the palps more slender than in older specimens, and the sublateral impressions on the cucullus are scarcely discernible.

One of the smallest specimens (the real larvæ excepted) is 3.1 mm. long with second leg 4.2 mm. It has only four joints in second tarsus, three joints in third, and two joints in fourth tarsus. Cephalothorax has the median groove well developed excepting towards the anterior margin, but some of the other grooves are partly or wholly indistinct, and the cucullus has no sublateral impressions. The animal is more yellowish than older specimens.

The larva with three pairs of legs has been described above (p. 22).

Remarks. — As already mentioned *C. Fœæ* is allied to *C. Afzelii*, but it is much smaller, the granules on body and

limbs are more scattered, and the distal portion of the tibial part of the palp is less thickened. As the male *C. Afzelii* is unknown, it is at present impossible to point the secondary sexual differences between the males of the two species.

Occurrence. — Portuguese Guinea (near lat. 12° N.), at two places: Bolama, June—December 1899, many specimens; Rio Cassine, January—April 1900, numerous specimens.

ORDER OPILIONES

This order comprises three sub-orders, viz. Palpatores, Laniatores, and Cyphophthalmi. The collection contains a rich material of the Laniatores, but with the consent of Dr. Gestro it has been handed over to a colleague. The small but interesting material of the two other sub-orders is dealt with on the following pages.

Sub-Order O. Palpatores.

It is an interesting and curious fact that Mr. Fea, who was a most excellent collector, has secured only two specimens during his voyages in West Africa; animals of this sub-order must consequently be very scarce in the countries investigated. Both animals are fortunately adult males; they belong to two different genera, and both belong to the family Phalangioidæ. A few years ago Dr. C. Fr. Roewer published the two first parts of his monograph of the Palpatores in: *Abhandlungen aus dem Gebiete der Naturwiss. herausg. vom Naturwiss. Verein in Hamburg*. The second part of this work has the title: *Revision der Opiliones Palpatores (= Op. Plagiostethi), II Teil; Familie der Phalangiidæ* (l. c. Vol. XX, I, 1912); it deals

with three of the six sub-families into which he divided the family. On p. 10 he separates the sub-family Phalangiinae from the five others in having no horizontally protruding process on the lower side of first joint of the antennae (he named these appendages mandibles), while such a process is constantly found in all the other sub-families. According to this definition my two genera belong to his Phalangiinae. But it has been more difficult to refer them to any of the numerous genera accepted or established by Dr. Roewer; one of them I refer to an old genus, but I find it necessary to establish a new genus for the reception of the other.

***Dacnopilio insularis* n. sp.**

Pl. III, figs. 2 a—2 d.

Male.

Body oblong, with the posterior margin, seen from above, somewhat flatly rounded; the skin coriaceous and rather flexible. Surface of cephalothorax with a considerable number of conspicuous, triangular, acute denticles distributed in the following way: a transverse group of about sixteen such denticles occupies the anterior half of the area in front of the ocular protuberance, and some among these spines are placed on the front margin; obliquely outside and in front of each antero-lateral angle of the ocular protuberance a single denticle is found, while each more lateral part of the surface has eight or nine denticles. The supra-antennal area has below a pair of very distinct denticles, and between this pair and the upper margin rudiments of a second pair. The two posterior thoracic segments are well marked off, and each has a transverse row of similar teeth.

The ocular protuberance is middle-sized, longer than high, without any median furrow, but armed with seven rather low teeth distributed in two rows (fig. 2 b); the protuberance is scarcely as long as its distance from the front margin.

The five anterior abdominal tergites each with a transverse band of small denticles; on the fifth tergite this band is narrow, consisting of a row and closely in front of this some few denticles; on the other tergites the band is broader and the denticles are placed more irregularly. On the sixth tergite denticles are very feebly developed, while the two following tergites are smooth.

The antennæ are considerably elongated and thickened, stretched out nearly as long as the body. First joint is directed forwards and considerably upwards, twice as long as thick, somewhat curved, with most of the upper margin rather convex (fig. 2 c), while the lower margin has its long middle part concave and is convex towards both ends. The upper surface of the joint has a number of denticles a little smaller than those on the cephalothorax, while the major posterior part of the lower surface has a lower number of somewhat longer teeth; the sides are nearly smooth. Second joint twice as long as, but not thicker than, the first, and measured to the tip somewhat more than three times as long as third joint; seen from the side the upper margin of second joint is mainly directed forwards and conspicuously concave which is due to a pronounced transverse impression; the joint from the upper margin to the insertion of third joint is a little fusiform, and the upper part of its front surface has a moderate number of somewhat small denticles.

Palps somewhat longer than the body, moderately strong, with the tarsus slender. Trochanter obliquely triangular with some teeth on the upper side. Femur a little longer than the tarsus, increasing in thickness from base to near the end, subangular, with longitudinal rows of small, acute denticles. Patella without apophysis, but with some quite minute denticles on the upper surface. Tibia without apophysis, a little curved, on the lower side with one denticle or two minute denticles

somewhat from the base, and a minute denticle at the terminal margin. Tarsal claw simple.

Legs of middle length. First coxæ with a considerably number of granules, each with a short, black seta; the other coxæ with the granules and setæ more feebly developed. First pair of legs with femur, patella and tibiæ considerably thicker than in third or fourth pair, and much thicker than in second pair. Femora of first pair only a little shorter than the body, conspicuously clavate (fig. 2 d) and somewhat curved, with longitudinal rows of well developed, triangular denticles and a number of scattered denticles, but without any process at the end. Second femora considerably longer than the body; the three posterior pairs of femora with rows of denticles distinctly smaller than those on first pair. Patellæ and tibiæ of all legs with the denticles conspicuously smaller than those on the respective femora and partly rudimentary; tibiæ more or less subangular.

Colour of the body yellowish-grey, with some dark spots above; palps light yellow, but their femora, excepting at the end, the proximal part of tibiæ and the end of the tarsi dark. Legs in the main as the palps, with the distal part of the femora and patellæ brownish, while the subdistal part of the tibiæ is only slightly darker than the proximal part.

Length of the body 5.6 mm., first legs (without coxæ) 20 mm., second legs 34.5 mm.

Remarks. — This new species is more related to *Dacnophilio* Roewer than to any other genus. Roewer has described two species, which differ much from one another in armature and probably also in size of the mandibles in the male, and the new species seems in some features to be intermediate between the two other African forms.

Occurrence. — The single specimen, an adult male, was taken in February 1902 in 1300—1400 m. above the level of the sea at Moka on the Island of Fernando Póo.

Megistobunus n. gen.

Allied to *Megabunus*, but differs in several features. Body very small, with the dorsal skin coriaceous and rather hard, excepting on the three posterior abdominal segments. Cephalothorax highly vaulted (fig. 3 a), even somewhat conically raised above, and last segment distinct; no frontal median spine; supra-antennal area without denticles. Abdomen has the tergites of the five anterior segments fused nearly as a shield, but each segment has a spiniform process or denticle in the median line.

Ocular protuberance extremely large, constricted at the base, and adorned with a few pairs of extremely long processes; eyes proportionately small.

Antennæ somewhat small, normal and simple in the male; first joint without ventral process.

Palps (fig. 3 c and 3 d) longer than the body, moderately slender. Femur with longitudinal rows of triangular denticles, but without longer processes. Patella with a half dorsal, half interior apophysis which is long and somewhat slender. Tibia on the inner side produced into a quite short but distinct apophysis. Tarsus nearly as long as the femur; claw simple.

Legs extremely long. First coxæ scabrous below, as they have a number of irregularly scattered granules while the other pairs are less scabrous, and no pair possesses any regular row of denticles at the anterior or posterior margin. Femora similar in shape and thickness, without any secondary articulation, but with rows of small denticles; no elongate spines at the end of femora or patellæ.

Remarks. — The genus is established on a single adult male. The animal is in general aspect rather similar to a very long-legged *Liobunum*, a genus from which it is very remote in important features. It is related to *Megabunus*, but differs from the forms of this genus in the following features: the dorsal

cuticle of the cephalothorax and of the major part of abdomen is rather hard; the front margin of the head without any strong median process; the five coalesced abdominal tergites each with a median spine; the femora of the palps without processes and only with normal denticles below; the legs extremely long, and all denticles quite small¹).

Megistobunus longipes n. sp.

Pl. III, figs. 3 a—3 d.

Male.

Cephalothorax highly vaulted; its penultimate segment moderately, its last segment well, marked off. The front margin with a few small denticles. Above the openings of the stink-glands is at each side a longitudinal row of three oblong-triangular processes, and a smaller denticle is seen near the base of the ocular protuberance; between this protuberance and the frontal margin several minute denticles are scattered. The first thoracic segment has at the front margin a transverse row of three pairs of conspicuous teeth and a couple of denticles at the lateral margin; second segment has a transverse row with some few denticles.

The ocular protuberance extremely large, with three pairs of conical, slender and very diverging processes (fig. 3 b); the third pair are exceedingly long, a little longer than first pair, and about twice as long as second pair. The protuberance,

¹) When I looked over Dr. Roewer's descriptions of the genus *Megabunus* and its three species, I found his work very far from satisfactory. In the diagnosis of the genus he says: "Palpen kräftig", but in the description of *M. diadema*: "Palpen klein und schwach", and at the two other species respectively: "Palpen klein" and: "Palpen kürz". In the diagnosis of the genus he says: "Beine lang and dünn", in the description of *M. diadema*: "Beine nicht sehr lang; dünn", of *M. rhinoceros*: "Beine kürz", and of *M. Grouvellei*: "Beine dünn, wenig lang". That generic characters as those quoted on *Megabunus* are sheer nonsense can scarcely be denied.

excepting a lateral portion around each eye, is set with numerous denticles, among which those in a narrow belt below the eyes are somewhat large, and the denticles diminish much in size downwards and disappear near the base of the protuberance; the processes are armed with conspicuous denticles.

The abdominal shield has a median row of five spiniform processes or teeth; the process on second segment is larger than that on the first, and the latter is larger than the third, while those on fourth and fifth segment are mere denticles; first and second segment each besides with a transverse row of two pairs of conspicuous denticles, while on the three other segments corresponding denticles are small or wanting. The free abdominal tergites and the ventral surface of the abdomen nearly smooth.

Palps not inconsiderably longer than the body. Trochanter distally with a few granules above and below. Femur a little curved and slightly thickened towards the end, with rows of denticles on the lower side and granules on the upper surface. Patella with two marginal rows of granules above; the apophysis slightly longer than the patella itself (fig. 3 c and 3 d) and somewhat shorter than the tibia, moderately slender, but with the subdistal part slightly thickened and everywhere clothed with short hairs. Tibia proximally with very incomplete rows of granules; the terminal inner apophysis (fig. 3 d) is short, shorter than broad, hairy.

Legs extremely long, very slender. Coxæ of first pair with a moderate number of irregularly scattered, setiferous granules, while the other pairs are less scabrous. Femora subsimilar, excepting that second pair are distinctly more slender than the first, and all with rows of small denticles; patellæ with very few denticles, while the denticles on the tibiæ are very small and partly rudimentary.

Colour of the body, antennæ, palps and coxæ yellowish; the upper side of abdomen, trochanter and femur of the palps with a brownish tint, the patellar apophysis and the apex of the palps brown, the distal part of the antennal fingers black; ocular protuberance and its processes black excepting the constricted base. Legs dark yellowish brown, patellæ dark brown, trochanter and base of femora brownish black.

Length of the body 3.8 mm., first legs 28 mm., second legs 64.5 mm., fourth legs 44.5 mm.

Remarks. — In general aspect rather similar to *Liobunum*; second pair of legs seventeen times as long as the body.

Occurrence. The single specimen was captured in August—September 1901 in an altitude of 400—500 m. at Basilé on the Island of Fernando Póo.

Sub-order O. *Cyphophthalmi*.

The main work on this sub-order is H. J. Hansen and W. Sörensen: On two Orders of Arachnida. Cambridge 1904. It contains descriptions of two genera from Africa, each with a single species, viz. *Ogovia grossa* H. J. H. & W. S. from Ogové in æquatorial France, and *Purcellia illustrans* H. J. H. & W. S. from Cape. The material to hand comprises a new species of *Ogovia* and another form, for the reception of which a new genus must be established.

Ogovia Hans. & Sör.

This characteristic genus hitherto comprised a single species, *O. grossa*, established on an adult female, and the male was unknown. The new species, though easily separated from *O. grossa*, agrees excellently with every character found in the generic description excepting as to two particulars, viz. that the produced median frontal plate is so large that it cannot be called "brevior", and that the inner marginal keel of first

pair of coxæ is proportionately somewhat shorter, being scarcely half as long again as the distance between its end and the tip of coxa. As both sexes of the new species are to hand, it may be added to the generic description that the sexes differ from one another not only in the two usual points, viz. the shape and position of the genital aperture and the male process on the upper side of fourth tarsus, but besides the abdomen has in the male behind the genital aperture a process directed much backwards, and the median anterior part of the ventral abdominal surface is excavated.

Ogovia nasuta n. sp.

Pl. III, figs. 4 a—4 c; pl. IV, figs. 1 a—1 f.

Male and Female.

Body thick, scarcely three-fourths as long again as broad, considerably broader than deep, with the median part of the dorsal surface of abdomen and of the hind part of cephalothorax rather flatly convex.

Cephalothorax anteriorly produced into a proportionately large, triangular and much vaulted plate (figs. 1 a and 1 b) which is somewhat broader than long with the end subacute, the lateral margins a little convex, and the surface densely and finely granulated; this plate overlaps the major part of first joint of the antennulæ. The lateral surface between the lamina mentioned and the "conus foetidus" — the process with the aperture of the odoriferous gland at the end — is somewhat hollowed, so that the anterior median part of the cephalothorax is shaped about as a very broad, rounded keel; the posterior transverse furrow is much arcuate, posteriorly at the middle flatly concave and a little or considerably nearer to the furrow limiting the abdomen than the length of the first abdominal tergite at the median line. The surface is very densely and finely granulated and besides, excepting anteriorly on the sides,

adorned with a number of much larger, scabrous and badly defined granules or rather quite small, irregular tubercles.

The "coni foetidi" are subtriangular (fig. 1 a), broader than long, directed outwards and somewhat forwards; their anterior margin is, seen from above, somewhat convex to a little from the protruding terminal part, but seen from in front this shape is seen to be due to the fact that each conus has its front subterminal part considerably excavated at the anterior end of the two labial plates limiting the terminal orifice.

Abdomen above with granules as on the major part of cephalothorax. The seven anterior tergites divided by a sharp furrow in the median line. On the ventral side (fig. 1 b) the first furrow is curved forwards inside the spiracle and reaches the margin of fourth coxa. The anal operculum is somewhat vaulted, and seen partly from behind distinctly broader than long. The whole ventral surface is densely and moderately finely granulated, excepting the hollowed median part in the male mentioned later on.

Antennæ (fig. 4 a) nearly as in *O. grossa*. First joint has the dorsal transverse rounded keel very conspicuous, and the upper and most of the outer side of the free part of the joint is distinctly granulated. The hand of the chela is somewhat less than three times as long as broad, smooth on the anterior side, and not fully twice as long as the movable finger.

Stomotheca conspicuously more than half as long again as broad at the distal end (figs. 1 c and 1 d).

Palps (fig. 4 b) about as long as the antennæ measured from the proximal margin of the transverse dorsal keel, in the main as in *O. grossa*, yet differing in having the trochanter a little more slender and femur more oblique with both the upper and the lower margin more convex.

Legs very short and thick, considerably shorter than in *O. grossa*. Lower surface of first pair of coxæ not lower than

on second pair. Femora of first pair (fig. 4 c) conspicuously curved upwards with the lower margin rather concave excepting towards the base; of second pair feebly curved, while the two other pairs are straight (fig. 1 e). Tibiæ somewhat longer and deeper than the patellæ, in the anterior pairs about half as long again as deep, in fourth pair proportionately a little longer. Tarsi of first pair (fig. 4 c) slightly less deep than the tibiæ, and the "solea" occupies little less than half of the lower margin of the tarsus.

The upper side of the body with numerous extremely short, thick, fusiform or rather clavate hairs which increase a little in number posteriorly, so that they are closer on the posterior abdominal tergites than on the cephalothorax; the ventral surface has a number of normal hairs which are longer and thicker on the coxæ than on the abdomen, where they are short and very thin. The legs, excepting their tarsi, have a number of very short, fusiform hairs on the upper surface and normal hairs on the lower side of the joints, while the tarsi have only normal hairs which on the lower side are longer than on the other joints — excepting of course the solea of first pair which is densely clothed with very short and thin hairs. The palps have the three distal joints well haired, while the hairs on their femoral part are shorter and less numerous, and the trochanter has only some hairs on the most distal part; the first joint of the antennæ has a very moderate number of hairs.

Sexual differences well developed. In the female the tarsus of fourth pair of legs normal, shaped as the preceding pair; in the male the fourth tarsus (fig. 1 e) increases nearly gradually conspicuously in height from rather near the base to beyond the middle, and it is above at the middle produced into a moderately large, nearly regularly conical, slightly curved process which is somewhat longer than deep at the base and directed backwards and considerably upwards; this

process is scarcely divided into a proximal and a much shorter distal part.

In the male the genital aperture (fig. 1 c) is nearly twice as broad as long, with the anterior margin considerably curved, the posterior margin feebly concave; the genital arculi (*m*) posteriorly rather narrow, anteriorly considerably widened inwards, at the median line about as long as the aperture, and with the anterior, the inner, and the posterior margin of their front part distinctly raised. No genital operculum is marked off, but a little behind the genital aperture projects a large, broad, oblong, subacute process (*p*) directed downwards and mainly backwards; this process is somewhat depressed and even slightly hollowed on the proximal part of its lower side; at the sides and behind this process the ventral surface of the abdomen is considerably excavated, and the excavation, which is oblong, occupies more than half of the surface between the base of the process and the front (lower) margin of the anal operculum. — In the female (fig. 1 d) the genital aperture is still shorter than in the male; the genital arculi are not marked off from the coxæ and each terminates in a subacute angle. The genital operculum is not marked off posteriorly, in front it is very narrow with the end cut off transversely, and it is deeply impressed just behind that end; the surface of abdomen has no process and no excavation as in the male.

Colour dark. Body and first joint of the antennæ from dark reddish-brown to blackish brown; the distal joints of the antennæ and the legs more or less dark reddish-brown, with the tarsi frequently a little lighter; palps brownish yellow, with the distal joints lighter.

In the male figured the body is 3.45 mm long and 2 mm broad, cephalothorax 1.6 mm long, first leg 2.5 mm, fourth leg 2.6 mm. The single female is 3.52 mm long and 2.07 mm broad.

Remarks. — *O. nasuta* is distinguished from the female of *O. grossa* by a number of features, and some among them may be pointed out. The frontal plate overlapping the antennæ is much longer and broader than in *O. grossa*; the granulation on the upper side of the body is very different, the legs considerably shorter in proportion to the body, and the solea of the first tarsus is conspicuously longer in proportion to the length of the whole lower margin of the tarsus.

A curious feature may be mentioned here. On the two figures of the legs (figs. 4 c and 1 e) are seen some rings (*x*), viz. femur, tibia and tarsus each with two rings (the distal ring of fourth femur placed on its upper margin), patella and metatarsus each with a single ring; each ring signifies a circular area which is well marked off, considerably vaulted and very smooth and shining. Similar areas are also found both above and below on the body; on fig. 1 b an area (*x*) is seen on each coxa, and a pair on most of the abdominal sternites. Similar vaulted, shining areas has also been observed in *O. grossa*, but they have not been found in any other genus of the suborder. One is inclined to think that these areas, which as to outer shape and aspect are somewhat similar to small eyes, may be organs of some quite unknown significance.

Immature Specimen. — The animal (fig. 1 f), measuring 2.3 mm in length, is proportionately broader than the adults. The body is yellowish brown; the articulating skin between the five posterior abdominal sternites constitutes darker transverse bands; the legs are light yellowish. Fig. 1 f as compared with fig. 1 b shows several differences due to age: lobe of second pair of coxæ feebly developed, the surroundings of the future genital aperture very different from the structure in the adult, with broad membrane around the arculi (*m*) (first abdominal sternite), finally the bands of articulating skin between the abdominal sternites.

Occurrence. — The material, consisting of 3 adult males, 1 adult female and an immature specimen, was taken at Musola, Island of Fernando Póo, January 1902, in an altitude of 400—500 m.

Parogovia n. gen.

Cephalothorax anteriorly produced into a triangular plate (fig. 2 a), which covers at least the inner part of the transverse keel on first joint of the antennæ. A median keel on cephalothorax is not developed.

Eighth and ninth abdominal sternites completely fused, and besides fused with the ninth tergite so that not even a vestige of any furrow between these plates is seen (fig. 2 b).

No eyes.

“Coni foetidi” moderately long, seen from above nearly obliquely triangular, directed outwards and feebly upwards, and about half as long from the lower margin of the cephalothorax as the length of the basal diameter of the cone. The end of each cone has a very oblong and very convex, smooth and shining area or piece, which looks almost as a single moderately thick lobe.

First joint of the antennæ (fig. 2 e) not reaching to the end of the femur of the palps, considerably compressed, on the lower side raised as a large, rounded tubercle, and above with the proximal transverse keel well developed. The teeth on the movable finger subsimilar in shape, moderately high, rounded; on the fixed finger two kinds of teeth alternate (fig. 2 g), half of them being larger than on the movable finger, moderately high and rounded, while each interval between two such teeth is occupied with an extremely low but somewhat broad tooth, with the free margin a little convex.

The palps (fig. 2 h) have the trochanter proximally slender, distally much thickened with some granules, somewhat shorter

than the femur which is slender and scarcely compressed; the tarsal joint scarcely as long as the tibial.

First pair of coxæ (figs. 2 c and 2 d) anteriorly produced into a triangular process; the distance between the front end of that process and the angle terminating the marginal keel of the stomotheca is only somewhat shorter than the length of the last-named keel. Stomotheca with the middle parts of its limiting keels nearly parallel, and towards the end it is a little widened, only somewhat narrower at the front end — between the angles — than the length of the marginal keels. The thin-skinned part of each maxillary lobe (fig. 2 c, *h*) is divided into two portions distant from one another; the basal portion is normal, while the distal portion constitutes a freely protruding, oblong, rounded lappet.

First pair of coxæ considerably broader than those of second or third pair, and much narrower than fourth pair (fig. 2 b).

Metatarsi conspicuously more than half as long as the tarsi. Solea of first pair of tarsi (fig. 2 i) occupies considerably more than half of the length of the lower margin of the tarsus, and is rather well defined from the proximal part of the lower side.

Tarsi of first and second pairs without any longitudinal dorsal furrow.

Claws simple, without saw-teeth; those of fourth pair of legs (fig. 2 k) much longer than first pair (fig. 2 i).

Sexual differences only found in the genital aperture with the arculi, and in the tarsi of fourth pair.

Remarks. — The genus *Parogovia*, which most decidedly belongs to the subfamily Stylocellini H. J. H. & W. S., agrees with *Ogovia* and differs from *Stylocellus* especially in five characters, viz. that the cephalothorax is anteriorly produced into a triangular plate, that it has no eyes, that eighth and ninth abdominal sternites are completely fused with one another and with the ninth tergite, that first coxæ are produced

into a triangular process, and that the two anterior pairs of tarsi have no dorsal furrow. It agrees with *Stylocellus* and differs from *Ogovia* in having the claws on fourth pair of tarsi much longer than first pair, and in some features in the palps, as their femoral part is not expanded and conspicuously longer than the trochanter, their tibial part longer than the tarsus. It differs from both genera in having the membranous part of the maxillary lobe of first coxæ developed in a peculiar way, in the aberrant terminal part of the conii foetidi, in having no trace of dorsal keel on the cephalothorax, finally in the antennulæ, as the first joint has a single large tubercle on the lower side, and the fixed finger has two kinds of teeth.

The single species known is in general aspect somewhat similar to *Siro*, though it decidedly belongs to the other subfamily.

Parogovia sironoides n. sp.

Pl. IV, figs. 2 a—21.

Body (fig. 2 a) moderately thick, more than three-fourths as long again as broad, much broader than deep.

Cephalothorax almost as long as the abdomen (fig. 2 a), anteriorly without real lateral excavations and without any median keel; the front lamina of moderate size, triangular, broader than long, subacute. The posterior transverse furrow is much arcuate, very feebly developed excepting at the middle, where it is more distinct and flatly curved, and here its distance from the furrow limiting the abdomen is three or four times shorter than the length of first abdominal segment. The surface of cephalothorax is rather densely granulated; the granules are well developed, not confluent; the lower side of the coxæ more finely granulated.

Conii foetidi nearly as long as broad; the end is rounded and shows, seen from above, an oblong and oblique, smooth, shining area.

Abdomen with the tergites undivided in the median line and densely granulated; the granules, which on first tergite are nearly as on cephalothorax, decrease gradually in size posteriorly, so that they are distinctly smaller and besides more dense on the posterior tergites. On the ventral side the first furrow is moderately curved (fig. 2 b) and terminates without being produced forwards inside the spiracle; the anal operculum is somewhat vaulted, and seen partly from behind broader than long; the whole ventral surface is densely and finely granulated.

Antennæ rather long. First joint seen in situ from above (fig. 2 a) four times as long as broad at the base, and here scarcely as broad as the conus foetidus; it is granulated above and on the more proximal part of the lower side. The hand of the chela is a little more than five times as long as broad (fig. 2 f), smooth on the anterior side, and more than three times as long as the movable finger.

Palps (fig. 2 h) about as long as the externally visible part of the antennæ. Femur considerably longer than the trochanter, about four and a half times as long as deep, with several granules on the lower margin. The tarsal part slightly shorter and a little thicker than the tibia.

Legs (figs. 2 i and 2 k) moderately robust; first and fourth pairs a little shorter than the body. Surface of first pair of coxæ not lower than that of second pair. Femora of first pair with the distal half distinctly curved, so that the lower margin is conspicuously concave (fig. 2 i); the other femora nearly straight. Tibia somewhat longer, but not deeper, than the patella, about twice as long as deep. Tarsi of first pair (fig. 2 i) a little deeper than the tibia, with the lower margin rather angular somewhat before the middle, and the solea occupies about three-fifths of the lower margin of the joint.

The upper side of the body moderately haired; all hairs very thin and most of them very short, cylindrical, not acute; the lower surface of abdomen has but few hairs, while on the coxæ the hairs are more numerous and moderately long. The legs have a good number of hairs (figs. 2 i and 2 k), most of them normal, acute, but on the proximal joints and especially on the femora many of the hairs are shorter and not acute. The palps hairy excepting the major proximal part of their trochanter (fig. 2 h).

Sexual differences only moderately conspicuous. In the female the tarsus of fourth pair is shaped as third pair; in the male the fourth tarsus is near the base on the upper side (fig. 2 k) produced into a process as long as the depth of the tarsus, rather slender, somewhat tapering from the base to beyond the middle, with the short distal part (fig. 2 l, *t*) marked off and oblique-triangular, acute; the process is directed somewhat upwards and much backwards and is distinctly curved; the upper surface of the tarsus below the proximal half of the process is, seen from the side, somewhat concave. — In the male the genital aperture (fig. 2 c) is nearly circular; a genital operculum is not marked off posteriorly, but its front margin is almost semicircularly concave; the arculi are somewhat narrow, almost three times as long as broad at the base, and not much decreasing in breadth from the base forwards. In the female (fig. 2 d) the genital aperture is a little smaller than in the male and differs somewhat in shape; the genital operculum (*r*), which is very short, is marked off by a transverse impression, and has its front margin straight, and this margin is much shorter than the breadth of the aperture; the arculi are moderately broad and at the base considerably broader than in the male (*m*), with the inner margin regularly concave.

Colour. — The body is dark reddish brown, with the coxæ and the anterior part of the cephalothorax still darker,

blackish; legs and antennæ lighter reddish brown; palps yellow.

The single male is 2.46 mm long and 1.47 mm broad, cephalothorax 1.21 mm long, antennæ from the base of the transverse keel 1.58 mm long, palp 1.58 mm, first leg 2.3 mm, fourth leg 2.3 mm long. The female is about of the same size; its body is 2.48 mm long and 1.41 mm broad.

Remarks. — Rather similar to species of the genus *Siro*, but proportionately broader, with the legs a little shorter and conspicuously thicker, and besides differing in the shape of the front margin of the cephalothorax and in several important features (shape of stomotheca, and of both pairs of maxillary lobes, hairs on second antennal joint, etc.).

Occurrence. — The two specimens were captured in the Island of Fernando Póo; the male at Punta Frailes in Oct.—Nov. 1901, the female at Basilé in Aug.—Sept. 1901 in an altitude of 400—600 m.

Explanation of the Plates.

Plate I.

Fig. 1. *Charinus africanus* n. sp.

Fig. 1 a. Left palp, from the lower, outer side; $\times 8$.

— 1 b. Left tibia, from the upper side; $\times 8$.

— 1 c. Left tarsus, from the outer side; $\times 8$. — *u.* upper margin.

Fig. 2. *Paracharon caecus* n. gen., n. sp.

Fig. 2 a. Cephalothorax with antennæ and left palp, from above; $\times 8$.

— 2 b. Left palp, from the lower outer side; $\times 13$.

- Fig. 2 c. Left tibia, from the upper side; $\times 13$.
 — 2 d. Left tarsus, from the outer side; $\times 13$. — *u.* upper margin.
 — 2 e. Distal joints of left fourth leg, from above; $\times 23/3$.

Fig. 3. *Trithyreus parvus* n. sp.

- Fig. 3 a. Left palp and first leg of the male, from the outer side; $\times 20$.
 — 3 b. Left palp of the male, from the outer side; $\times 35$.
 — 3 c. Left palp of the female, from the outer side; $\times 35$.
 — 3 d. Left first foot of the male, from the side; $\times 47$.
 — 3 e. Left first foot of the female, from the side; $\times 47$.
 — 3 f. Left fourth leg of the male, from the side; $\times 20$.
 — 3 g. Left fourth leg of the female, from the side; $\times 20$.
 — 3 h. The three posterior abdominal segments with flagellum of a male, from above; $\times 60$.
 — 3 i. The same segments with flagellum of a male, from the side; $\times 60$.
 — 3 k. Posterior abdominal segments with flagellum of a female, from the side; $\times 60$.

Fig. 4. *Trithyreus brevicauda* n. sp. (continued).

- Fig. 4 a. Foot of first left leg of the female, from the side; $\times 46$.
 — 4 b. Left fourth leg of the male, from the side; $\times 20$.
 — 4 c. Major part of left fourth leg of the female, from the side; $\times 20$.
 — 4 d. Posterior abdominal segment with flagellum of a female, from the side; $\times 62$.

Plate II.

Fig. 1. *Trithyreus brevicauda* n. sp. (continued).

- Fig. 1 a. Left palp and first leg of the male, from the outer side; $\times 20$.

- Fig. 1 b. Left palp of the male, from the outer side; $\times 43$.
 — 1 c. Left palp and first leg of a female, from the outer side; $\times 20$.
 — 1 d. Left palp of a female, from the outer side; $\times 43$.
 — 1 e. Foot of first leg of the male, from the outer side; $\times 46$.
 — 1 f. Posterior abdominal segments with flagellum of a male, from above; $\times 62$.
 — 1 g. Posterior abdominal segments with flagellum of a male, from the side; $\times 62$.

Fig. 2. *Cryptostemma crassipalpe* Hans. & Sør.

- Fig. 2 a. Cephalothorax of an adult female, from above; $\times 12$.
 — 2 b. Cucullus of an adult female, from in front; $\times 16$.
 — 2 c. Left mandibular palp of an adult female, from in front; $\times 22$.
 — 2 d. The two anterior right legs of the adult male, from above; $\times 9$. — Hairs omitted.
 — 2 e. The two anterior right legs of the adult female, from above; $\times 9$. — Hairs omitted.
 — 2 f. Major distal part of first right leg of the female, from above; $\times 21$.
 — 2 g. Distal part of third left leg of an adult male, from in front; $\times 25$. — *a.* terminal portion of the tibia; *b.* metatarsus; *c.* its movable process; *d.* first tarsal joint; *d*¹. first joint of its movable process; *d*². second joint of the same process; *e.* second tarsal joint; *e*¹. front margin of its distal lower wall of its 'lamina cyathiformis'; *e*². posterior high wall of the 'lamina cyathiformis'; *f.* third tarsal joint.
 — 2 h. Tarsal movable process of the organ shown in fig. 2g, essentially from below; $\times 58$.

Fig. 3. *Cryptostemma Feæ* n. sp.

- Fig. 3 a. Cucullus of a male, from in front; $\times 15$.
 — 3 b. Left antenna, from behind (from below); $\times 23$.
 — 3 c. Portion of the front side of the right first femur of a female; $\times 65$.

Plate III.

Fig. 1. *Cryptostemma Feæ* n. sp. (continued).

- Fig. 1 a. Left mandibular palp of an adult male, from in front; $\times 20$.
 — 1 b. First and second right leg of an adult male, from above; $\times 15\frac{1}{2}$.
 — 1 c. First and second right leg of an adult female, from above; $\times 15\frac{1}{2}$. — Granules and hairs omitted.
 — 1 d. Major part of first right leg of the same adult female, from above; $\times 15$.
 — 1 e. Tarsal movable process of the copulatory organ in third left leg of an adult male, from in front; $\times 42$.
 — 1 f. Distal half of the same movable process, from the outer side; $\times 47$.
 — 1 g. Body with left palp and the more proximal joints of all three pairs of legs of a larva, from below; $\times 15$.
 — 1 h. Metatarsus and tarsus of second right leg of a larva, from above; $\times 21$. — s. sensory seta.
 — 1 i. Metatarsus and tarsus of third leg of a larva, from above; $\times 21$.

Fig. 2. *Dacnopilio insularis* n. sp.

- Fig. 2 a. Body with left antenna and palp of a male, from the side; $\times 11\frac{1}{2}$.
 — 2 b. Ocular protuberance of the male, from the side; $\times 24$.
 — 2 c. Left antenna of the male, from the outer side; $\times 17\frac{1}{2}$.

Fig. 2 d. Femur of first right leg of the same male, from in front; $\times 17/2$.

Fig. 3. *Megistobunus longipes* n. gen., n. sp.

Fig. 3 a. Body with left antenna, palp, and the proximal parts of the legs of an adult male, from the side; \times scarcely 8.

— 3 b. Ocular protuberance of the same male, from the side; $\times 13$.

— 3 c. Left palp of the same male, from the outer side; $\times 13$.

— 3 d. Patella, tibia and proximal part of tarsus of the same palp, from above; $\times 16$.

Fig. 4. *Ogovia nasuta* n. sp.

Fig. 4 a. Left antenna of a male, from the outer side; $\times 24$.

— 4 b. Left mandible with palp of a male, from the outer side; $\times 24$.

— 4 c. First left leg of a male, from the outer side; $\times 23$.
— *x*. vaulted, smooth and shining circular areas.

Plate IV.

Fig. 1. *Ogovia nasuta* n. sp. (continued).

Fig. 1 a. Cephalothorax and the two anterior abdominal segments of a male, from above; $\times 16$. The plate from the front end covers the major part of first joint of the antennæ; of the palps only trochanter and femur, of the three following pairs of legs the protruding ends of the coxæ and the proximal part of the trochanter are drawn; of fourth legs only the end of the coxæ is rendered.

— 1 b. Body with coxæ and trochanteres of all walking legs of a male, from below; $\times 14$. Antennæ and man-

dibles with palps removed; granulation and hairs omitted. — *x*. vaulted, smooth and shining circular areas.

- Fig. 1 c. Middle portion of the anterior half of the body of the same male, from below; $\times 23$. — *f*. angle limiting the stomotheca in front; *h*. soft portion of the maxillary lobe of first coxa; *m*. genital arculi; *p*. process originating a little behind the genital aperture.
- 1 d. Middle anterior portion of the body of a female; from below; $\times 26$.
- 1 e. Left fourth leg of a male, from the outer side; $\times 23$. — *x*. vaulted, smooth and shining circular areas.
- 1 f. Ventral side of an immature specimen; $\times 15$. — *m*. genital arculi.

Fig. 2. *Parogovia sironoides* n. gen., n. sp.

- Fig. 2 a. Body with the proximal joints of the appendages of a male, from above; $\times 10$.
- 2 b. Body of the same specimen, from below; $\times 16$. — Granulation and hairs omitted.
- 2 c. Middle portion of the anterior half of the body of the same male, from below; $\times 32$. — *f*. angle limiting the stomotheca in front; *h*. soft part of the maxillary lobe of first coxa divided into two portions somewhat removed from one another; *m*. genital arculi.
- 2 d. Middle portion of the anterior half of the body of a female, from below; $\times 32$. — *r*. genital operculum.
- 2 e. Left antenna of a male, from the outer side; $\times 32$.
- 2 f. Second and third joints of the same antenna, obliquely from the upper and outer side; $\times 36$.
- 2 g. Distal portion of the same antenna; $\times 108$.

- Fig. 2 h. Left palp of a male, from the outer side; $\times 32$.
— 2 i. First left leg of a male, from the outer side; $\times 27$.
— 2 k. Fourth left leg of a male, from the outer side; $\times 27$.
— 2 l. Upper part of the tarsus of the same fourth leg more highly magnified. — *s.* proximal, and *t.* terminal part of the dorsal process.

ON STRIDULATION IN CRUSTACEA DECAPODA

I. Introductory Remarks.

It is a well-known fact that stridulating organs exist in a number of species belonging to genera of very different families of Crustacea Decapoda; most of our knowledge on this topic down to the year 1899 has been put together by Ortmann in Bronn: Klassen und Ordnungen des Thierreichs, Bd. V, II. Abth., Crust. 2, p. 1245. Structural features interpreted as stridulating organs have been discovered in three species of *Penæopsis* (de Man, 1911) of the family Penæidæ; in several species of some genera of the Palinuridæ (Ortmann, l. c.); in *Thalassinia anomala* Herbst (Pearse, 1911) of the family Thalassinidæ; in *Coenobita rugosa* H. M.-Edw. (Hilgendorf, 1869) of the family Coenobitidæ; in *Clibanarius strigimanus* White (Henderson, 1888) of the family Paguridæ, and in a number of crabs. Among the tribe Oxystemata such organs are known only in the species of the genus *Matuta* (Hilgendorf, 1869; Ortmann, l. c.); in the tribe Oxyrrhyncha they are unknown; in the old tribe Cyclometopa they exist in *Pseudozius Edwardsii* Barr. (Barrois, 1888) of the family Xanthidæ, in *Ovalipes bipustulatus* H. M.-Edw. (Wood-Mason, 1878) of the family Portunidæ, and in a few African species of the genus *Potamon* (Calman, 1908) of the family Potamonidæ. In the tribe Catometopa organs are found in all species excepting one of the genus *Ocypoda* (various authors), in some species of *Macrophthalmus*, in *Helice* and *Metaplax* (Hilgendorf, de Man, Ortmann), all belonging to the

family Ocypodidæ; finally in some species of *Sesarma* and *Heterograpsus* (Hilgendorf, de Man, Ortmann) of the family Grapsidæ.

In most cases it is easy to recognize a stridulating organ. Excepting in the genus *Potamon* and perhaps in *Thalassina* (see later on) it consists always of a very regular row of granules or small tubercles or a file-like series of ridges, playing the role of a fiddle, while the role of the bow is performed by a ridge or a small, regular row of granules or very short ridges, or by a sharp margin. In some cases, as in *Ocypoda*, the fiddle is moved to and fro against the ridge-shaped bow; in other cases, f. inst. in *Penæopsis*, the sharp margin acting as bow is moved forwards and backwards against a ridged area. The structure in *Potamon* is completely different: a patch of modified spines on the coxa of each of the two anterior pairs of thoracic legs is moved against very modified spines on thickened lobes from the lower margin of the carapace (Calman, Ann. Mag. Nat. Hist., ser. 8, vol. I, 1908, p. 469); the structure in *Thalassina* is unknown to me. — The sound has been heard in living animals of at least two species of *Palinurus* (several observers), some species of *Ocypoda* (Hilgendorf, Ortmann, Anderson, Alcock), *Thalassina anomala* (Pearse)¹), and *Matuta* (Ortmann). But even if living animals have not been observed, the organ is easily interpreted when both the fiddle and the bow are well developed, or, as is the case in *Penæopsis*, the fiddle is so characteristic that no doubt remains. But in some cases, f. inst. in *Coenobita rugosa*, the interpretation of the structures in question is less certain, as either the fiddle or the bow is not developed in such a way, that it is possible to decide with absolute certainty whether the

¹) Pearse's treatise scarcely exists in Copenhagen. But according to Calman's "record" the animal stridulates, and as I have been unable to discover the organ in question it may be supposed that it is either aberrant in structure or perhaps to be found in some unexpected or hidden place, consequently that Pearse who studied the habits of the animal, heard the stridulation.

parts are used by the living animals as a stridulating organ.

Many years ago I discovered casually a highly developed stridulating organ in a species of *Ovalipes* (family Portunidae), and afterwards a fine organ in the genus *Acanthocarpus*, belonging to the family Calappidae in the tribe Oxystomata. The aim of the present small treatise is not only to describe these new organs, but to mention the structure in forms of the genus *Ocypoda*, to consider the curious occurrence of organs both in terrestrial forms, in amphibious Decapoda and in real marine species, two among them inhabiting even moderately deep water, finally from comparison with other classes of animals to point out analogies and the need of further biological observations of living Decapods.

II. Organs in the genera *Ovalipes* and *Acanthocarpus*.

1. *Ovalipes* (*Platyonichus*) *ocellatus* Herbst. — On the lower side of each half of the carapace and considerably from the antero-lateral margin is seen a long, narrow, slightly raised area, which is parallel with the direction of that margin and consequently arcuate; it begins somewhat from third maxillipeds and reaches to outside the insertion of the cheliped. This area has a large number of rather coarse, transverse ridges completely similar to each other in breadth and extremely regularly arranged, radiating in the direction of the postero-exterior angle of the coxa of the cheliped. The area is broadest near the middle and tapers towards both ends and especially towards the anterior end; consequently the ridges towards this end are gradually shorter, and those near the end only oblong, small tubercles. The part acting as bow is found on the merus of the chelipeds, the upper side of which has proximally in front an oblong area with very regular oblique ridges — in a large female to hand 8 ridges — and these terminate as slight protuberances on the

front margin. When the chelipeds are moved forwards and backwards a moderately strong sound is produced.

(More than forty years ago Wood-Mason pointed out a special feature in another species of the genus *Ovalipes* (*Platyonichus*), viz. *O. bipustulatus* M.-Edw., and interpreted it as a stridulating organ. The lower surface of both chelæ have a good number of transverse, serrated ridges, but these are not fully as regular as usual in a stridulating organ, and I have been unable to point out with certainty any part which can act as bow; in this case observation of living animals are necessary for settling the question.)

2. *Acanthocarpus Alexandri* Stimps. — Both chelæ are similar; each is large, very high, with the inner side somewhat flat; on this smooth surface is seen a somewhat curved, vertical, distinctly raised area somewhat before the insertion of the movable finger. The area reaches about to the upper margin of the chela and occupies scarcely three-fourths of its height; its upper half is somewhat broad, but it tapers rapidly above and slowly from the middle downwards; the area is adorned with a high number of very fine and very closely set ridges which are very oblique on the long median line of the area, and the ridges are equally close in its whole length. On the lower side of the orbit and further outwards somewhat below and a little behind the front margin of the carapace runs an oblique, thick keel, which is broadest at its middle, narrower towards both ends and especially outwards; each keel has 8 or 9 transverse, rounded, rather thick ridges arranged very regularly, and each interval is about twice as broad as one of the ridges. When the chela is moved forwards-upwards and in the opposite direction below the front part of the carapace, it is rubbed against the ridged keel described, and produces a rather high sound. — This species has been taken in West Indies and somewhat more northwards in depths from 71 to 150 fath.; one of the

specimens in the Copenhagen Museum is from near 200 fathoms.

Another species of the same genus is *A. bispinosus* A. M.-Edw., which is described and figured by A. Milne-Edwards and Bouvier in *Memoirs Mus. Comp. Zool.* vol. XXVII, no. 1, 1902, p. 127; the specimen was taken in 140 fathoms. Fig. 6 on pl. XXV in that work represents the inner side of a chela and shows a striated vertical area not mentioned in the text; this area agrees much with that found in *A. Alexandri*, and accordingly *A. bispinosus* has a stridulating organ completely as developed as in the other species.

III. Organs and their use in the genus *Ocypoda*.

Though the organs found in various species are well known and even afford excellent specific characters, it is necessary for the following considerations to mention two main types. At least 14 species of this genus are accepted as valid, and a stridulating organ is found in all excepting a single form. In this genus the part acting as fiddle is always found in both sexes on the inner side of the large chela, and that area is rubbed against a ridge on the lower side of the ischium of the same leg. In the American *O. quadrata* F. a robust, subvertical keel is found somewhat before the fingers, and this keel has a rather low number of coarse and regularly but not closely set granules; *O. platytarsis* H. M.-Edw. from India shows a rather similar structure. In the Asiatic *O. macrocera* H. M.-Edw. the keel is somewhat low, flattened above, with the lower half of its surface moderately broad, the upper half tapering to the end. Near the upper end this area has rather coarse ridges moderately distant from each other; from the upper end downwards to beyond the middle the ridges become gradually finer and more closely set, and on the lower third they are very fine, and the impressions between them extremely narrow. In the common

Indo-Australian *O. ceratophthalma* Pall. the area differs somewhat from that in *O. macrocera*; the area tapers upwards from a little below the middle, and nearly these three-fifths have somewhat coarse ridges moderately remote from each other, while further below the ridges are suddenly very fine, all equally fine and close together. The area can therefore be compared with a fiddle bearing two chords; when its major upper part is moved against the ridge on ischium the tone produced is deep; when only its lower part is used the tone is very much higher. — *O. macrocera* can even produce three tones in using respectively the upper, the middle or the lower part of the area. On these musical possibilities see later on.

The species of the genus *Ocypoda* are not marine, but unfortunately our knowledge of their biology, especially of their musical faculties, is imperfect. The best account of a species is written by Alcock in "Administration Report of the marine Survey of India for the official year 1891—92"; he observed *O. macrocera*, and the part of his account (p. 16) necessary for my purpose shall be reprinted here. "They are gregarious, and though at times they may be seen marching (migrating?) in battalions across the sand, they usually live in "warrens" at and above high-water mark, where they excavate tortuous burrows and when alarmed flying each one to its burrow". "The sounds can be heard, and their effect seen, by forcing one crab, which we will call the intruder, into the burrow of another, which we will call the rightful owner. The intruder shows the strongest reluctance to enter, and will take all the risks of open flight, rather than do so, and, when forced in, he keeps as near the mouth of the borrow as possible. When the rightful owner discovers the intruder he utters a few broken tones of remonstrance, on hearing which the intruder, if permitted, will at once leave the burrow. If the intruder be prevented from making

his escape, the low and broken tones of the rightful owner gradually rise in loudness and shrillness and frequency until they become a continuous low-pitched whirr, or high-pitched growl, the burrow acting as a resonator". In a paper published in 1900 the same author says: "One almost certain use of the stridulating-organ is to give warning to intending trespassers, of its own species".

On *O. ceratophthalma* Anderson wrote (Journ. Asiatic Soc. Beng. vol. LXIII, 1894, p. 138): "A loud croaking noise At first I imagined it must be caused by frogs, so perfectly did it resemble the croaking of these animals it proceeded from the burrows of the *Ocypoda* crab which here fringed the beach at high-water mark. The burrows are frequently, in coral sand, very wide at their mouth (6 to 8 ins.) and then taper gradually downwards, so that they act as excellent resonators. The cause of the stridulation of the crabs was by no means apparent, the animals were all lying hidden in their burrows, and several were croaking at the same time, as if in concert". — Ortmann visited a place inhabited by the same species; he says (l. c.) that all specimens were in their burrows, and the sound produced was "a deep bass-tone".

It is easily seen that the curious structure of the fiddle in *O. matrocera* and *O. ceratophthalma* is not explained by the observations quoted.

IV. On Stridulation.

Among the above-named stridulating Decapoda the species belonging to the family Palinuridæ and the genera *Penæopsis* and *Acanthocarpus* are purely marine animals. *Ocypoda* is terrestrial. *Ovalipes ocellatus* is amphibious, "not unfrequently taken at the surface of the sea", and "perfectly at home among the loose sands at low-water mark, and also abundant on sandy bottoms off shore"; "when living at low-water mark on the sand

beaches it generally buries itself up to its eyes" (Stebbing, 1893, from Verrill and Smith); *Matuta* seems to live under rather similar conditions. The other forms, possessing either decidedly stridulating organs or features interpreted as such are either terrestrial (*Coenobita rugosa*) or amphibious or inhabiting shallow water at the shore.

Stridulating organs of types built according to the same principles as in terrestrial or amphibious Crustacea are known in many Insects and in some Araneæ, but it is interesting that the organs in really marine Decapoda are in principle similar to those in terrestrial forms. (*Potamon* and *Thalassina* are left out of consideration). The first thing to be noted is that the organs in Decapoda exist in both sexes; scarcely any species has been observed, in which only the male possesses an organ absent in the female; only in *Penæopsis* there seems to be some insignificant sexual difference in the size of the stridulating area (De Man, 1911).

With good reason Calman writes (1909): "In the case of purely aquatic species, the function of these organs is less easy to understand". But analogies can be pointed out. A good number of fishes of very different families are known to produce sounds; in many forms the sound is produced by the air-bladder specially adapted for that purpose, in others by the first strong ray in the pectoral fins, or the anterior rays in the first dorsal fin, or the first ray in the ventral fins, or by the præoperculum. (Readers taking interest in this matter may be referred to the excellent work by Dr. William Sørensen: *Om Lydorganer hos Fiske*. 1884. Sørensen describes and explains the instruments, but says nothing on their biological use). A more close analogy is *Corixa*, a genus of Hemiptera, of which several species inhabit fresh water in Europe, and they stridulate very well; *Pelobius Hermannii* of the family Dytiscidæ may also be noted.

Stridulating organs built according to the same principle as in *Penæopsis*, *Acanthocarpus*, *Palinuridæ*, etc. are known in males of European Araneæ as *Asagena* and *Steatoda* and in numerous Insects, thus in both sexes of Necrophoridæ, in most Cerambycidæ, in the genus *Crioceris* (fam. Chrysomelidæ), in several genera of Lamellicornia and in the larvæ of at least most types of that big family (the Lucanidæ included), in some other Coleoptera, in the Reduviidæ (Hemiptera), etc. (The organs in Cicadidæ, Locustidæ etc. are omitted here). In all the terrestrial Arthropoda enumerated we find an area, or two areas, with regularly arranged and generally fine to extremely fine, transverse ridges, and a sharp margin, a row of minute tubercles, or the end of rostrum acts as bow. We generally know little and frequently nothing on the biological role of the organ in most of these Insects, but it must be emphasized that in every form known to me the ridges on a stridulating are similar as to thickness and distance; consequently one might suppose that only a single tone could be produced, and that modulation must be rather limited. But that is in reality not always the case; for the best proof of the opposite, and the most interesting observation on the use of stridulating organs of the normal structure we are indebted to J. C. Schiödte (Naturh. Tidsskrift, 3. Række, B. VII, 1870, p. 188). Schiödte experimented with specimens of *Necrophorus*, especially *N. vespillo*, and writes: "When listening to a flower-pot in which several specimens of *Necrophorus* are about letting down a carcass [of a small mammal or bird], one hears distinctly that they during the work underground communicate mutually by the language of stridulation. The sound is now higher and hasty, now deeper and smothered, and on the whole modulated in the most manifold way. Sometimes a pause is suddenly interrupted by a single sharp tone instantly answered by a similar one from another specimen or simultaneously from several specimens,

and one gets the impression of the different moods agitating the animals during the pains of the work: eagerness, impatience, fretfulness, weariness, exultation; and sometimes the whole company makes a kind of chorus-cry for the measured regulation of the work”.

And let us now turn to the stridulating organs in such forms as the terrestrial crabs *Ocypoda ceratophthalma* and *O. macrocera* described above. It is instantly seen that they are more highly developed than, for instance, those in *Necrophorus*, because they in the first-named species can produce two very different tones, in the latter form even three tones. Whether the animals really use this faculty is unknown (see p. 62), but it may be supposed that they occasionally do so. And the topic is, in my opinion, very interesting. But well planned — and, for the rest, probably somewhat difficult — observations of stridulating Decapoda and above all of species of *Ocypoda* with highly developed organs are needed; I even hope that this little treatise may create interest in some Zoologist, who has an opportunity for biological observations in the field or perhaps in a good “terrarium”.

ON THE POSTEMBRYONIC OCCURRENCE OF THE MEDIAN "DORSAL ORGAN" IN CRUSTACEA MALACOSTRACA

I. Introductory Remarks.

In a paper on *Sergestes* (Proc. Zool. Soc. London 1896) the present author wrote in the description of the youngest *Mastigopus*-stage of *S. arcticus* Kr.: "just in front of the gastro-hepatic groove is observed a short protuberance in the median line". — In his valuable paper: Zur Kenntnis der Metamorphose von *Sergestes arcticus* Kr. (Zool. Anz. Bd. XXXIII, 1908) E. Wasserloos writes (p. 318) in the description of the second Protozoëa-stage: "In der Mittellinie des Cephalothorax bemerkt man über dem Gehirn und dem Naupliusauge eine linsenartige Hervorwölbung des Chitins . . . die bisher bei keiner *Sergestes*-Larve ausser bei einigen Mastigopen von *Sergestes arcticus* von Hansen beschrieben worden ist. . . . An Schnitten habe ich ausser der Chitinbucht und der darunter liegenden, allerdings undeutliche Matrix nichts wahrgenommen. . . . Eine genaue Beschreibung und genaue Angaben über die erwähnte Hervorstülpung kann ich nicht geben, doch möchte ich eine Vermutung aussprechen: Die Lage des Organs über dem Naupliusauge und der Umstand, dass es mit der Zurückbildung des Naupliusauges ebenfalls verschwindet, lassen es als wahrscheinlich erkennen, dass die Protuberanz als Sammellinse für das Naupliusauge dient". His suggestion on the function of the protuberance is certainly erroneous.

While working out the rich collection of Sergestidæ collected by the Prince of Monaco, I observed the dorsal protuberance in

Acanthosoma-stages of five species and in young *Mastigopus*-specimens of several species, furthermore a rudiment of the same organ in adult specimens. The idea struck me that it must be the so-called "dorsal organ" known in embryos of Crustacea of most orders, but unknown in almost all adult Malacostraca and in larvæ of the same sub-class. In examining adults of a good number of species belonging to all orders of Malacostraca, I was surprised that the dorsal organ, though frequently looking only as a rudiment, exists in some or several representatives of most orders. It is found on the surface most frequently nearly vertically above the mandibles or their base.

II. On our earlier Knowledge.

Nearly all original observations on the dorsal organ are scattered in papers very different in contents, though the majority deal with embryology or development. In 1904 W. T. Calman's excellent hand-book on Crustacea was published; in 1913 W. Giesbrecht's part on Crustacea in Lang's *Handbuch der Morphologie* was edited. These careful authors had written "records" on the Carcinology during a number of years and were uncommonly well versed in the vast literature; the statements of both authors together in the books mentioned on the occurrence of the dorsal organ may therefore be considered nearly sufficient, and an extract is given here.

On *Anaspides* (the order Anaspidacea) Calman writes (p. 164): "On the dorsal surface [of the head], in front of the cervical groove, is a pigmented area with a circular central spot surrounded by four minute pits. The significance of this structure is quite unknown, but it may be comparable to an obscure "dorsal organ" apparently glandular in nature, occupying a similar position in certain other Malacostraca". It may be pointed out, that Calman in his treatment of the other orders of Malacostraca does not mention the occurrence of a "dorsal

organ" in the adult of any other form, but possibly he refers in the lines quoted to the organ found in embryos of other orders. — On the Tanaidacea he says (p. 194): "A paired "dorsal organ" is present" in the embryo; on p. 213: "A "dorsal organ" is present in many Isopod embryos, and assumes very different forms", which are mentioned. On the Amphipoda (p. 237): "A "dorsal organ" is early developed as a median thickening of the ectoderm. . . ." — On the embryo in Mysidæ (p. 179—80): "A pair of lateral thickenings of the epiblast appear very early and, approaching each other on the dorsal side, fuse to form an invaginated "dorsal organ". " But I may remark that Nusbaum und W. Schreiber in 1898 (Biolog. Centralbl. Bd. 18, p. 742) figured a transverse section of an embryo of *Mysis Lamorna* showing the unpaired dorsal organ and a pair of dorso-lateral organs, and all three organs have already begun to degenerate. — At the Nebaliacea, Cumacea, Euphausiacea, Decapoda, and Stomatopoda Calman does not mention any dorsal organ.

Giesbrecht writes (p. 156—57) that not only in Cladocera but in "vielen anderen Crustacea ein anderes Organ von meist drüsiger Struktur, ebenfalls in der Dorsalwand des Kopfes, das aber nur transitorisch (bei Embryonen, seltener Larven) auftritt und sich meistens schon früh zurückbildet; das ist die Nackendrüse (Nackenorgan, Nackenschild, Dorsalorgan. . .)". Among the Malacostraca it is found early in the embryo in Arthropoda (consequently Tanaidacea, Isopoda, and Amphipoda), in Cumacea, Mysidacea, perhaps also some Decapoda; "bei Lep- tostraken scheint es eine unpaarige Leiste zu bilden"; finally "als Nackendrüse aufgefasst wird auch . . . eine dorsale Drüsenscheibe in the Maxillargegend von jungen und adulten Euphausien etc.". I have been unable to find in the special literature on the Euphausiacea any statement on the organ.

In a small paper published in Journ. Linn. Soc. Lond. vol. XXIX (1903) the present writer pointed out an organ on the

surface of the head near the posterior margin in the Isopod *Bathynomus giganteus*; the organ—which shall be mentioned later on—was briefly described, figured and compared with the organ discovered by Calman (1896) in *Anaspides tasmaniae*; it was added, that I had found a vestige of the organ in the allied form *Cirolana borealis*. — The statements in the literature on the organ in larvæ of *Sergestes arcticus* are quoted above.

Let us sum up. The median dorsal organ has been found in embryos of representatives of the following orders of Malacostraca: Nebaliacea, Mysidacea, Cumacea, Tanaidacea, Isopoda, Amphipoda and perhaps some Decapoda. The Embryologists tell us that it, at least generally, is of glandular nature and disappears early; on its function nothing is known, besides it is unknown in the embryo of Stomatopoda. — In adult forms it has been found in *Anaspides* of the order Anaspidacea; in *Bathynomus* and a species of *Cirolana* of the order Isopoda; finally, according to the quotation from Giesbrecht, in young and adult forms of the order Euphausiacea. In larval stages it is only known in *Sergestes arcticus*.

III. The "dorsal organ" in adult Malacostraca and some larvæ.

It has not been my intention to inspect every genus available, but types of families or genera have been selected and examined with a good pocket-lens; it was found that within the same family, sometimes even within the same genus, an organ could not infrequently be discovered in a large species, but not with any certainty in small forms. The following enumeration shows that the organ has a much wider occurrence than might have been supposed.

I. *Nebaliacea*.

Nebalia bipes O. Fabr. — In turning the animal a little to and fro so that the light changes on the smooth, shining dorsal

surface of the head it is generally possible to perceive a faint vestige of a median protuberance situated not inconsiderably behind the base of the movable rostral plate.

2. *Anaspidacea*.

Anaspides tasmaniae G. Thoms. — Calman described and figured a very conspicuous dorsal organ (Trans. Roy. Soc. Edinburgh, XXXVIII, 1896). Nothing is to be added.

Paranaspides lacustris Geoff. Smith. — The organ is more reduced than in *Anaspides*, as there is no pigmentation; the very small pits are irregularly arranged, and their number in three specimens varies from 3 to 5.

3. *Mysidacea*.

Gnathophausia. — In a gigantic specimen of *G. īngens* Dohrn a part of the dorsal keel a little in front of its base and about 15 mm. long is flattened above and behind the middle distinctly thickened, this narrow area has a pair of very conspicuous, very oblique, convex spots marked off all around by an depression, and the spots look almost as scars. In *G. zoēa* Will.-Suhm about one mm. of the dorsal keel above the mandibles is, seen from above, rather considerably thickened but not flat; seen from the side with the light transmitted the dorsal chitine of this part is thin and the contents opaque, indicating that the tissue is of another quality than in the surroundings.

Eucopia. — In one specimen of *E. sculpticauda* Faxon a nearly circular, somewhat shallow depression situated above the mandibles somewhat in front of the anterior transverse furrow; the depression has a minute, dark point as if a scar after a prick with a needle. In another specimen the depression is wanting, but the dark point exists; in a third specimen nothing could be seen with certainty. In specimens of *E. unguiculata* Will.-Suhm nothing was found.

Lophogaster. — In *L. typicus* M. Sars no vestige is discoverable.

Boreomysis. — *B. scyphops* G. O. S. has somewhat in front of the gastric groove a moderately large and rather shallow depression, at the middle of which is seen a somewhat low, a little oval, rounded and very distinct protuberance with one to three minute pits. — *B. nobilis* G. O. S. has very near the gastric groove a small but rather high, a little oval protuberance without visible pits. — *B. microps* G. O. S. has a little in front of the gastric groove a conspicuous, nearly semiglobular, smooth protuberance.

Of the subfamily Mysinae two moderately large forms, viz. *Mysideis grandis* Goës and *Mysis mixta* Lilljeb., have been inspected, but no vestige of any organ was found.

4. *Cumacea*.

Some few larger forms have been examined, but nothing could be found.

5. *Tanaidacea*.

Some large specimens of *Apseudes* and *Alaotanaïs*, thus representatives for both families of the order, have been inspected with negative result.

6. *Isopoda*.

Idothea. — In *I. balthica* Pall. is frequently found near the posterior margin of the head a very small area a little broader than long, and with a few tiny pits or, in one specimen, with impressed transverse lines; the area is generally a little or somewhat depressed, but in one specimen it is larger than usual, raised and shining. In a well-sized specimen from Iceland the area is uncommonly conspicuous, moderately large, very slightly depressed, shining, with a large, oblong pit in the middle, and

around this 8 or 9 extremely minute, oblong pits. — In *I. emarginata* F. and *I. unguolata* Pallas organs somewhat similar to those in *I. balthica* are found.

Among other animals belonging to the sub-order Valvifera *Mesidothea sibirica* Bir., *M. Sabini* Kr., and *Arcturus Baffini* Sab. have been inspected, but with negative result.

Serolis. — *S. paradoxa* Fabr. has a very distinct though somewhat small, a little oblong, depressed area near the posterior margin of the head; the area has several tiny pits, especially near the margin. — *S. Schythei* Ltk. has a similar nearly circular area.

Bathynomus. — In *B. giganteus* A. M.-Edw. an organ was discovered, briefly described and figured by me in 1903 (see p. 68). I have examined a large immature female. Near the posterior margin of the head it has a most conspicuous, whitish spot, which does not show the numerous, irregularly impressed points on the surrounding brownish chitine. The spot is as a whole a little arched but depressed along the middle; each half has a small group of 6 or 7 minute pits; the median part has a very oblong area well marked off by an depressed line and with a linear depression in the median line; somewhat behind each group of pits is found a shallow excavation which has a number of oblique, parallel, impressed striæ; at the front end of the area is seen a group of some nearly rudimentary pits.

Cirolana. — In *C. borealis* Lilljeb. a very small group of three to six tiny pits is found near the posterior margin of the head; they are sometimes situated in a very shallow or very distinct depression. — A specimen of *C. Rossii* Miers has some irregularly scattered minute pits.

Æga psora L. and specimens of *Rocinela*, *Anilocra* and *Cy-mothoa* have been inspected with negative result.

Among the sub-order Asellota *Asellus aquaticus* L., *Munnopsis typica* M. Sars and *Munnopsurus giganteus* G. O. Sars,

among the Oniscoidea *Ligia oceanica* L. and the gigantic *Tylos granulatus* Krauss have been examined without finding any vestige of the dorsal organ.

7. Amphipoda.

Large specimens of genera comprising forms of very considerable size, as *Anonyx*, *Stegocephalus*, *Gammarus*, *Maera*, have been inspected, but the result was absolute negative.

8. Euphausiacea.

Thysanopoda. — In *T. egregia* H. J. H. the gastric keel — between the front margin and the gastric groove — has somewhat behind the middle a short part raised rather considerably; this part is cut off horizontally so that its upper surface is flattened, and this surface shows an aspect different from that of the surrounding integument. (The raised part is shown in fig. 21 in my paper on Schizopoda in Bull. Mus. Océan. Monaco, no. 30, 1905, p. 23) — *T. cornuta* Illig shows a similar structure. — In *T. aequalis* H. J. H. nothing could be perceived. — *T. microphthalma* G. O. S. has a feeble vestige on the gastric keel which on its highest part is a little flattened above.

In *Bentheuphausia amblyops* G. O. S. a vestige is scarcely perceptible.

In *Meganyctiphanes norvegica* M. Sars the gastric keel has a somewhat high and rather short part thickened upwards with the dorsal surface distinctly flattened; seen from the side with transmitted light the contents of the raised part is generally lighter than the surrounding tissue.

Euphausia. — In *E. superba* Dana the median keel is at some distance in front of the gastric groove more or less distinctly raised and thickened, and at each side of this part the surface of the carapace is distinctly excavated, but the keel itself is rounded above without vestige of any special structure.

In *E. Krohnii* Brandt no vestige.

In *Nematobranchion boopis* Calm. and *Nematoscelis megalops* G. O. Sars the gastric crest is at its highest point slightly angular and shows a vestige of the organ; seen from the side with transmitted light the contents of that part of the keel is lighter than the surrounding tissue.

Larvæ. — Some larvæ belonging to the genus *Euphausia* have been examined, but it was not possible to discover any rudiment of a dorsal organ. At a future occasion I will have to examine the vast material of larval forms secured together with adults in the North Atlantic by the Prince of Monaco, and then there will be a good opportunity to look for the dorsal organ in representatives of almost all genera.

9. Decapoda.

The dorsal organ is found in the adults of most species of the Penæidæ inspected by me, and in all genera and species of the Sergestidæ excepting *Lucifer*. Furthermore it was detected in several genera of the Caridea. Besides it was discovered in certain larval stages of the genus *Sergestes* and in a few larvæ of Penæidæ. In the following an account shall be given, but as to the genus *Sergestes* a brief abstract may be sufficient, because in a monograph of the North-Atlantic species secured by the Prince of Monaco and now in composition a more detailed report will be embodied. — In vain I have looked for the organ in a species of the genus *Cambarus*, and it is scarcely to be found in Astacidæ, Palinuridæ, Galatheidæ, etc. or in the crabs.

A. Penæidæ.

Aristeus. — *A. Edwardsianus* Johns. has a little behind the first dorsal spine the median keel thickened with its upper surface expanded; in the middle of this part is found a somewhat oblong area well marked off by a depression; this area has

slightly before the middle an oblong, dark-brown spot sharply defined and with at least one minute pit. — In *A. semidentatus* Bate is found a moderately small but uncommonly deep depression a little behind the first dorsal spine; the depression has a small, circular, somewhat convex area behind the middle.

Solenocera Agassizii Fax. — A little behind the first dorsal spine an oblong, rather depressed area with a small knot at the middle.

Penæus. — *P. setiferus* L. has considerably behind the first dorsal spine a proportionately somewhat long part of the median keel thickened and flattened above or even longitudinally a little excavated; the broadest part of that area has in one specimen an oblong pit, in another specimen nothing. It must be remarked that the area in question is situated more backwards than in any other genus of the Malacostraca. — In *P. caramote* Risso nothing could be discovered.

Larvæ. — In a gigantic larva in the *Mysis*-stage, measuring 20.5 mm. from the tip of rostrum to the end of telson and captured in the Pacific, a small, oblong and rather low protuberance is easily seen a little behind the origin of the rostral keel. — In a larva in an older *Mysis*-stage, belonging to a quite different, somewhat small type, an oblong and somewhat high protuberance is found a little in front of the gastro-hepatic groove; seen from the side the protuberance is directed upwards and forwards; the larva is from lat. $4\frac{2}{3}^{\circ}$ N., long. $107\frac{1}{2}^{\circ}$ E.

B. Sergestidæ.

Sergestes. — The organ has been found in adult specimens of everyone of the 15 species hitherto captured north of equator, but it could not be seen in every specimen of some of the smaller species, as *S. mollis* Smith, *S. arcticus* Kr., *S. atlanticus* M. Edw., *S. vigilax* Stimps., and *S. Edwardsii* Kr. The organ is situated a little or somewhat in front of the gastro-hepatic groove. It

is a small or very small area, in most cases distinctly or considerably raised as a rounded, nearly circular or transverse-oval protuberance, sometimes, but far from always, marked off by an depressed line; in a few cases the whole area is depressed. Frequently the area has a very distinct granule or raised point in front of the middle, in other cases a few tiny pits or no pit could be made out. In a few cases the area is brown, but generally of the same colour as its surroundings. There is also some individual variation in the area as to its height or the depth of its surrounding impression.

Petalidium. — In one specimen of *P. obesum* Kr. is found a moderately small, a little oblong and feebly elevated area with a tiny and more raised point in front. In some specimens an area was not discoverable with certainty, but the quality of the integument makes the investigation difficult and uncertain.

Sicyonella. — In one specimen of *S. maldivensis* Borr. a distinct, small group of five minute pits close behind the dorsal crest; in another specimen the group has nearly vanished.

Acetes. — In one specimen of *A. vulgaris* H. J. H. a group of six minute pits close together and somewhat in front of the rudimentary gastro-hepatic groove; in another specimen a rudimentary protuberance with vestiges of a few pits.

Lucifer. — No trace of any organ.

Larvæ of *Sergestes*. — As mentioned above (p. 66) Wasserloos discovered the dorsal organ — but did not interpret it as such — in the second Protozoëa-stage and the *Acanthosoma*-stages of *S. arcticus* Kr.; the present writer had found the protuberance in question in the youngest *Mastigopus* of the same species. The dorsal organ is an erect or distinctly procurved, rounded protuberance in the Atlantic *Acanthosoma*-stages known to me and belonging to *S. arcticus* Kr., *S. tenuiremis* Kr., *S. robustus* Smith, *S. corniculum* Kr., and *S. vigilax* Stimps.; the protuberance is generally easily seen from the side. It is also

found in the younger *Mastigopus*-stages of several and probably all species, but it differs sometimes considerably in aspect, as in *S. pectinatus* Sund it is shaped as a thick, short spine directed obliquely forwards. In the older larval stages it has apparently disappeared, but yet it exists in all probability, because it is found in adult specimens, though its aspect is quite different; I have not undertaken the certainly difficult investigation of the dorsal integument in front of the gastro-hepatic groove in older larvæ or very young specimens with black eyes.

Larvæ of *Lucifer*. — In the youngest *Mysis*-stage — without pleopods — of *L. Faxonii* Borr. a rather large and considerably vaulted dorsal protuberance is found above the base of the mandibles; it is not marked off in any way from the surrounding integument, and I am unable to decide whether it is homologous with the very characteristic protuberance in the *Acanthosoma* — or *Mysis*-stages — of *Sergestes*. In older stages, with pleopods, the protuberance is proportionately smaller.

C. Caridea.

Acanthephyra multispina Cout. — A little behind the first dorsal spine the median line has a small, circular depression surrounding a more or less distinct protuberance.

In *Nematocarcinus exilis* Bate a very small organ close at the base of the first dorsal spine.

In *Ephyrina* sp. from the North Atlantic the anterior crest of the carapace is somewhat from its base flattened above with a small but very distinct, circular, rounded protuberance, the surface of which has two or three pits so tiny that they could not be counted with certainty.

Pasiphaë. — In *P. principalis* Sund the dorsal keel is distinctly thickened considerably behind the rostrum, but a protuberance is wanting and no pit could be discovered. — A young *P. sivado*

Risso about 13 mm. long has a just perceptible, rudimentary protuberance considerably behind the rostrum.

In *Spirontocaris microceros* Kr. an area marked off by a circular depression very near the base of the first dorsal spine.

In *Bythocaris leucopis* G. O. S. a distinct rudiment in the keel a little behind the first spine.

In *Alpheus avarus* F. a small, but well developed depression a little or slightly behind the median keel.

Palæmon brasiliensis Hell., *Pandalus Bonnierii* Caull. and *Pontonia* sp. have been inspected with negative result.

10. *Stomatopoda*.

To begin with it may be remarked that moderately large to very large specimens of the present order have frequently the surface of the median part of the carapace more or less rubbed and are consequently badly fit for the investigation, as in such cases the dorsal organ is frequently difficult or impossible to point out with certainty.

The dorsal organ has been mentioned in descriptions — and besides shown in figures — of some species of the genus *Squilla* by at least two able Zoologists, viz. Stanley Kemp in his excellent memoir on the Indo-Pacific forms of the order (1913) and by Calman (1917). They name it the "dorsal pit", which is only a descriptive term, as they did not recognize what this pit really is. — It may also be pointed out that Giesbrecht in his useful, extremely elaborate, long-winded and as to literature not always very fair monograph of the Mediterranean Stomatopoda (1910) has not observed the "dorsal pit", though it is conspicuous in the common *Squilla mantis* L., at least sometimes not difficult to see in *S. Desmarestii* Risso, and ought at least to have been indicated on his large figures of the carapace of these two species.

Squilla. — In *S. mantis* L. the median keel is considerably widened and flattened above somewhat behind the bifurcation and far in front of the mandible; the widened, rather short part has a very oblong depression, the bottom of which is a little convex and looks as pricked feebly with a needle. — In *S. raphidea* F. the organ is conspicuous and nearly as in *S. mantis*. — In *S. Desmarestii* Risso was found in two of four specimens examined a small, circular, low depression with a rudimentary median pit; the depression is situated considerably in front of the mandibles. — In *S. gibba* Nobili the median carina is flattened and much widened a little behind the middle and has there a small, a little oblong, convex area surrounded by a rather deeply depressed ring, and placed a little in front of the mandibles.

Lysiosquilla. — In a rather large specimen of *L. eusebia* Risso a very small and feeble depression a little in front of the middle of the carapace above the mandibles; in another rather large specimen and in small specimens nothing could be observed. — In *L. maculata* F. no vestige was found.

Pseudosquilla ciliata F. — In two specimens a nearly circular, very conspicuous and somewhat deep depression with two or three tiny pits on the flat or a little convex bottom, situated a little in front of the middle of the carapace and somewhat in front of the mandibles. In a third specimen the depression is small and shallow, in a fourth quite rudimentary.

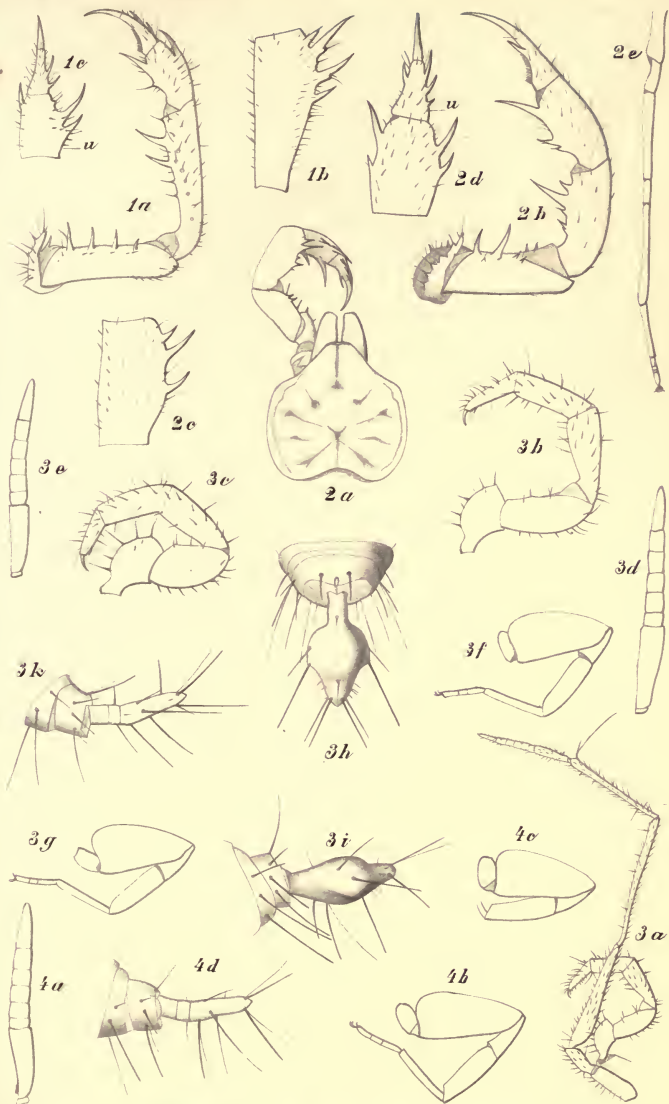
Odontodactylus scyllarus L. — Slightly behind the middle of the carapace a rather large, moderately shallow depression, in the middle of which a small, circular, somewhat convex area.

Gonodactylus Oerstedii H. J. H. — A deeper or more shallow, small, circular, depressed area a little behind the middle of the carapace and above the mandibles. In young specimens the depression is either considerably more feebly developed or not discernible.

Larvæ. — Specimens of *Alima*, *Pseuderichthus* and *Lysierichthus*, also the first stage, have been inspected, and the result was always negative.

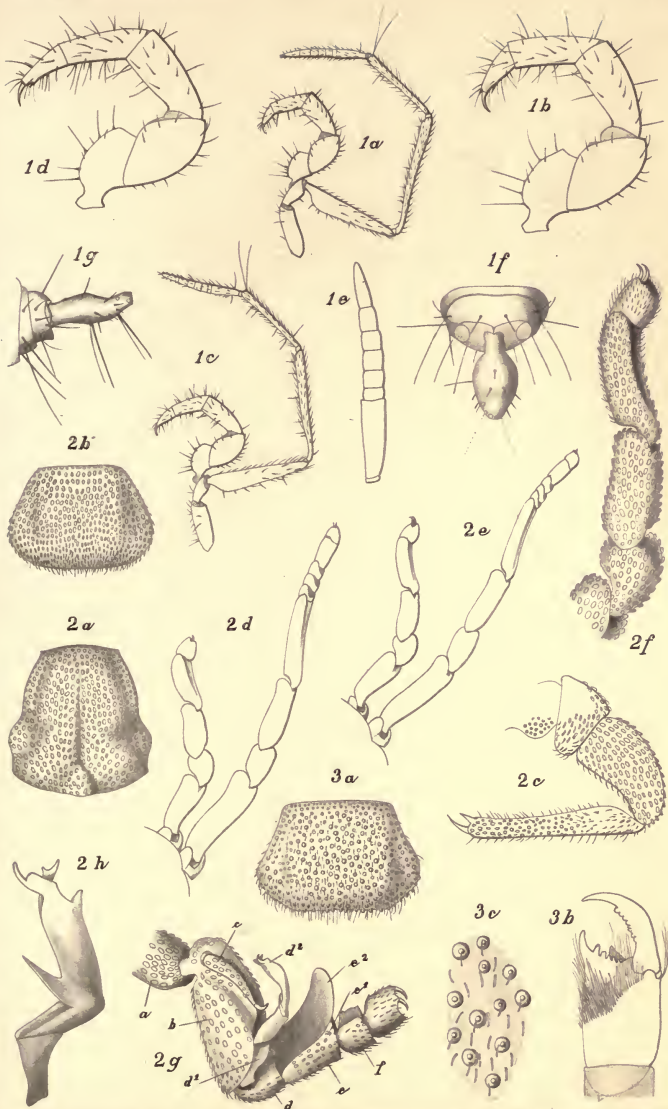
IV. Summary.

The preceding chapter shows that the "dorsal organ" can be observed on the posterior part of the dorsal surface of the head or on the carapace in adults of some or several genera of all orders of Malacostraca, excepting in Cumacea, Tanaidacea and Amphipoda. Whether it sometimes or frequently or even generally has a special function must be made out by a student, who has a good material either of living animals or of specimens especially preserved for histological research, for cutting by microtome. As the organ has such wide occurrence, it is no very probable that it has no function in the adult. And this supposition is strengthened by the fact that it exists in many and probably in most adult Stomatopoda, but seems to be wanting in their larvæ; that it should exist in the embryos of this order — on which nothing is known — then be absent in the larvæ but reappear in the adults, is highly improbable. We are in reality completely ignorant on the significance of the dorsal organ both in embryos, in larvæ and in adults, so ignorant that it seems scarcely possible to produce even a hypothesis. Perhaps experiments on living animals similar to those carried out by some authors in order to investigate the excretory system might yield some result.



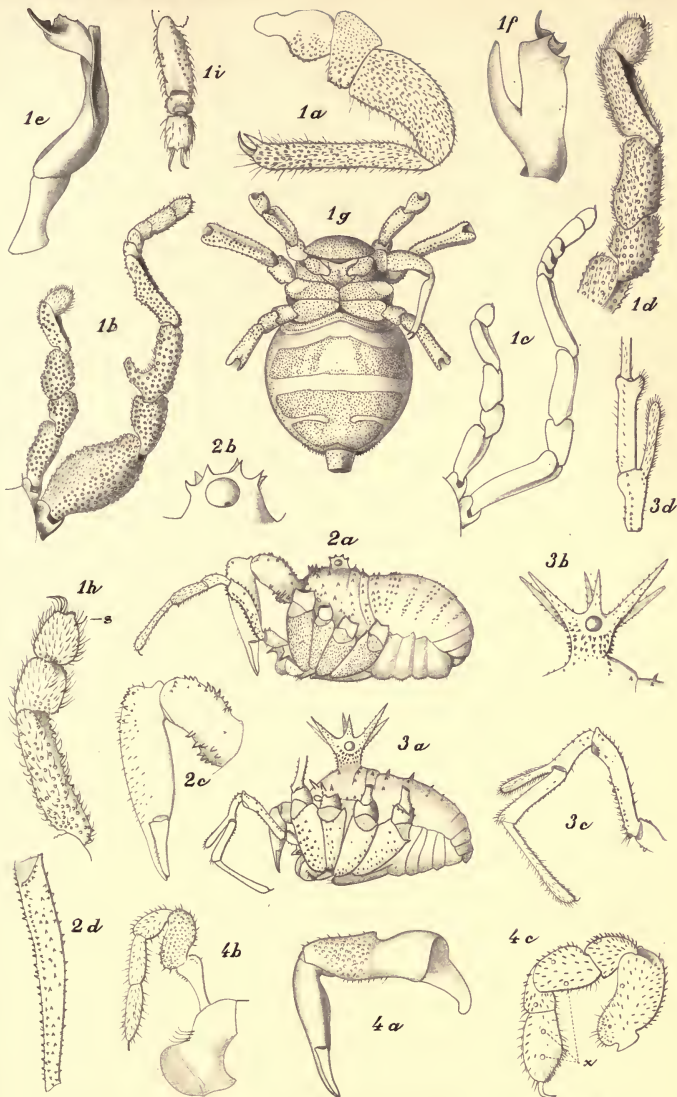
1. *Charinus africanus* n. sp. 2. *Paracharinus caecus* n. gen., n. sp.

3. *Trilhyreus parvus* n. sp. 4. *T. brevicauda* n. sp.

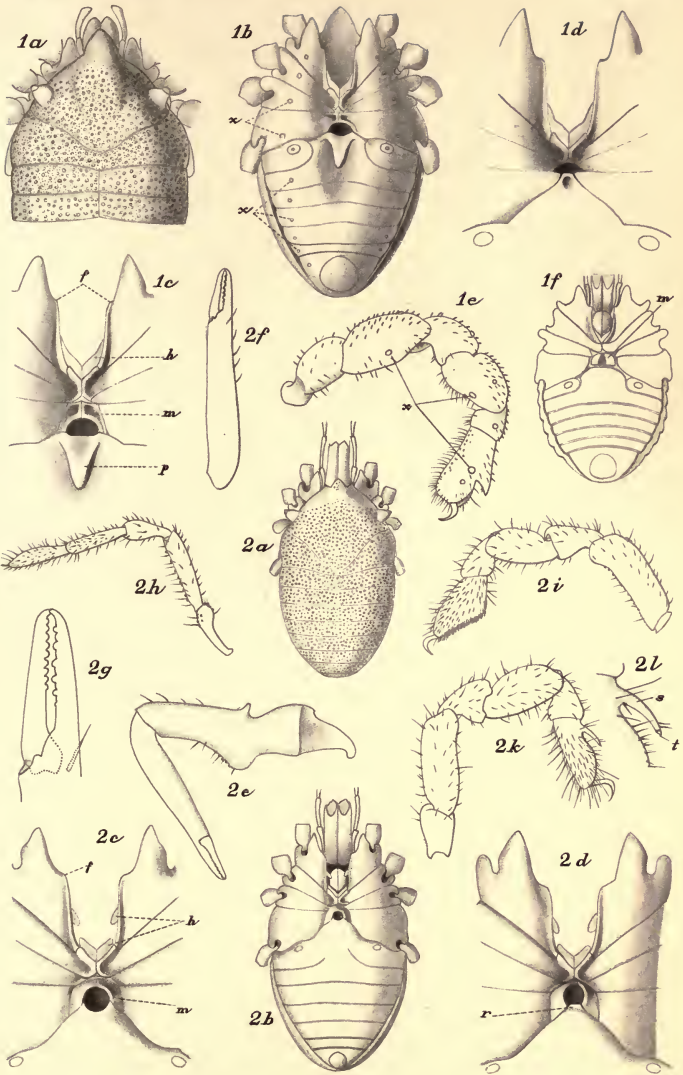


1. *Trithyreus brevicauda* n.sp. 2. *Cryptostemma crassipalpe* H&S.

3. *C. Fecé* n.sp.



1. *Cryptostemma Feca* n. sp. 2. *Dacnopilio insularis* n. sp.
 3. *Megistobunus longipes* n. gen., n. sp. 4. *Ogovia nasuta* n. sp.
 H.J. Hansen del.



1. *Ogovia nasuta* n. sp. 2. *Parogovia sironoides* n. gen., n. sp.

H. J. Hansen del.

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