The Notostigmata, a new suborder of Acari.

By

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With Plates IV—VI.

Introduction.

The following studies on this new suborder have been made on material included in the famous French Arachnologist E. Simon's rich collection and lent by him to Drs. H. J. Hansen and W. Sørensen. Through the kindness of the two Danish Zoologists and the great liberality of M. E. Simon I got the animals (two species) to study; the third species, *Eucarus Italicus*, has been received from the German naturalist Dr. C. Börner. Here I take the opportunity of tendering my best thanks to these four gentlemen, chiefly to M. E. Simon. I thank Dr. H. J. Hansen especially, because he has followed my studies with interest and good assistance, letting me draw from his full zoological experience; these thanks are still more natural when taken into consideration that he has troubled himself by verifying and correcting a good deal of my observations and has given good drawings of the more difficult objects.

I communicated some preliminary studies about the *Notostigmata* at the „Congrès des Naturalistes et Médecins du Nord tenu à Helsingfors 1902", and a short résumé has appeared in the „Comptes rendus" of this meeting. This résumé as most preliminary notes ought to be classed together with superfluous litterature, all its facts being included in this paper.

It will easily be seen that many, and partly important, questions are yet to be solved, — my own defects excluded — owing to the bad preservation of the material. The following observations some few ones, especially mentioned excepted refer to *Eucarus segmentatus*.

1. Shape and Segmentation of the Body.

The body of the Arachnids falls into three parts: the head, bearing the first four pair of appendages, the thorax, bearing two pairs, and the abdomen composed of a different number of segments. This theory which satisfactorily explains the singular position of the two last pairs of legs in most of the Acari is owed to the naturalist Dr. W. Sørensen and is shortly set forth by him and Dr. H. J. Hansen in their paper about „The Order *Palpigradi* Thor." (6 pag. 225); the main publication on this disputed theme ought to be expected with vivid interest.

The head of *Eucarus* is naturally divided into two distinct parts: the pseudocapitulum (pag. 145) and the proper head bearing the eyes. This last part is not sharply defined from the thorax which gradually merges into the abdomen. Between the head and the thorax there is a short but distinct dorsal groove in front of the blue transverse spot on the first thoracic segment (Tab. IV fig. 1. 1). The next groove between the two thoracic tergites is comparatively short and almost straight; the third one (fig. 1. 2) between abdomen and thorax, is bent forwards and goes from one margin to the other. It is most natural to draw the limit between the thorax and the abdomen at the last named groove, because it is much more marked than the preceding one. The inner dorsal longitudinal muscular band begins at the first groove, and according to this fact, and because it bears the eyes, it is most natural to regard the part in front of it as the head.

As there is no limitation betweeen the head and the thorax on the ventral side we may practically speak about a cephalothorax in *Eucarus* as in most other Arachnids. It is narrow in front, here forming a semi-roof above the pseudocapitulum, but it

is broader behind. The middle part is almost flat, only very little raised towards the abdomen, while it slopes laterally towards the almost perpendicular sides which bear rounded flat projections twice as long as broad above the first three pairs of the coxae; the first pair is placed somewhat higher than the second and this again higher than the third pair.

There are two oblong eyes on each side placed between the median line and the sides and just as near to the front as to the back margin of the head. Their longitudinal axes form an obtuse angle with each other.

The abdomen is twice as long as the cephalothorax and broadest at the middle. It is raised towards the middle, the highest part being nearer the front margin than the anal hill and consequently sloping more gradually backwards. The back of the abdomen is gradually curved from one side to the other, while the ventral side is flat. On the back side the abdomen is divided into ten tergites, distinguished from each other by grooves, distinct in front but more or less wiped out behind, and by two pair of muscular spots, the hindmost of which are the most distinct (pl. IV fig. 1 & 2 *m*). The muscular spots are corresponding to longitudinal bands of muscles. The inner row of spots is the most distinct; behind they are merging with each other into one single median spot. In many Acari it is difficult to make out if the dorsal grooves really correspond to the segments, but in this case the longitudinal bands of muscles put the segmentation beyond all doubt. The body is terminated by the anal hill, placed somewhat obliquely, more ventrally than dorsally. It is divided into a right and a left part, its distal part being often more or less invaginated. This anal hill must be regarded as the last (XI) abdominal segment.

The common opinion that the Acari are not at all segmented is not completely correct as shown by Kramer and other acarologs. Kramer has proved that *Alicus roseus* Koch has an abdomen composed of seven segments (Kramer 9 pag. 180). The development of the segments in the *Tarsonemidae* is yet more singular. The

Russian zoologist J. Wagner (19 pag. 149) has examined the embryo of *Ixodes* and found that the abdomen is segmented. The larval forms of *Rhyncolophus* K. have according to Berlese's drawings a segmented abdomen (1 Tab. X). It is thus evident that Acari with a segmented abdomen are not unknown even if such a great number of segments as in *Eucarus* have never been found.

On the ventral side (pl. IV fig. 3) it is quite impossible to distinguish the abdomen from the cephalothorax, because the foremost part of the abdomen, including the genital opening, is continued between the coxae and merges into the sternum. Such a position of the genital opening is also found in the *Gamasidae*; a similar position is most typical in the *Opiliones*. The position of the genital opening is sufficient to make it evident that the abdomen is prolonged between the coxae, for the genital opening is always abdominal in the Arachnids; in most of them it is found in the second abdominal segment („Hansen & Sørensen" 6 pag. 232).

The coxae are small and placed near to each other on each side. The distance between the first pair is smaller than that between the second pair. The third pair is farther removed from each other than the second but the fourth and more oblong pair is placed nearer to the middle line (pl. IV fig. 3). Between the coxae there is a distinct sternum, the front part of which is placed at a higher level than the rest. The front margin is articulated to the pseudocapitulum by a thin articulation-membrane. The articulation-cavity of the pseudocapitulum is directed obliquely down- and backwards so that the pseudocapitulum naturally has a forward and downward position.

Between the first pair of coxae and at the base of the pseudocapitulum two pointed, slender, movable organs (pl. IV fig. 3 & 19 *a*) are placed. A thin pointed hair is articulated at the outer side near their tips and they are terminated by another hair. This organ is most similar to Kramer's unpaired „Bauchtaster" or Winkler's „Unterlippe" (20 pag. 324), in the *Gamasidae*. Winkler homologizes this organ with the labrum in the other Arachnids.

His theory is founded upon the fact that this organ is placed at the base of the pseudocapitulum, and this interpretation seems to me the most natural, though his prooves are not quite sufficient.

2. Sense Organs and Hairs.

A. *Sense Organs.* The skin is granular all over with small round or elongated, irregular, flat granules, except where the muscles are fastened; these ellipsoid, muscular, not impressed spots are encircled with somewhat larger granules and are mostly found at the sides where the transverse lateral muscles are fastened. The body (the head excepted) is sprinkled all over with lyriform fissures of different kinds.

(1). *Common fissures* (pl. V fig. 13 *lf*), similar to those found in many Arachnids especially in the *Chelonethi* (H. J. Hansen 7 pag. 205—211. pl. IV fig. 12) are found at the thoracic and first abdominal tergites. The first thoracic tergite has only four fissures, the second about 40, the first abdominal tergite bears about 24 and the second about 16, placed between the two longitudinal muscular bands (fig. 13 l^1 & l^2). The fissures are about 25 μ long and more or less straight or irregularly twisted.

(2). The greater number of fissures consist of two solid ridges surrounding an oval thin-skinned space and uniting at their tips which are more or less pointed. The oval space is divided into two parts by a longitudinal thin line, swollen at the middle (pl. IV fig. 17). Their length is 63 μ and their breadth 18 μ. The number of these organs is about 250, there are none at the head and the sternum, few along the sides and at the thoracic tergites, but they are abundant below, behind the genital opening (pl. V fig. 13 *la*).

(3). The sternum is provided with a third kind of fissures which, as shown (pl. IV fig. 19 *f*) are arranged in a regular manner. In the middle behind the foremost lateral group of hairs there is on each side an obliquely placed organ which is bent a little backwards; in the same transverse line but more outwards there are two straight organs. Behind the two median organs and forming a square with them there are placed two oblique small organs. The structure is not quite alike in the different specimens, as the thickness of the chitinous bars and the space between them vary. The first median organ which is the most typical, consists of a foremost thick chitinous ridge provided with a median longitudinal fissure, and a hindmost ridge more or less marked. In the hindmost median organ it seems to be the hindmost ridge which is provided with a fissure; sometimes there seems to be fissures in both ridges.

The tibiae, patellae and metatarsi of the legs are sometimes provided with deep narrow incisions.

B. *Eyes.* The eyes have a very well developed lens and are thickly pigmented inwards.

C. *Hairs.* The body and especially the legs are provided with hairs of different size and structure; the sternum and genital plates of the males are mounted with thick, comparatively short and pointed hairs which are well articulated and sometimes provided with small pointed branches or spines; about seven hairs of the sternum are placed on a little hill on each side in front of the median front fissure; behind there are placed a comparatively great number of hairs of which sometimes a single one is bipartite (pl. IV fig. 19). The copulatory suckers are provided with hairs which will be described later on (pag. 167). The dorsal surface of the „head" (pl. IV fig. 16) is provided with numerous well articulated, comparatively clumsy, short and stalky hairs with small branches. The whole abdomen is hairless with the exception of the anal hill and the tenth tergite which bear hairs similar to those of the head but somewhat longer and more slender.

In contrast to the body the legs are provided with many hairs of different kinds; only those which are found in greater number will be described here.

(1). *Pointed, slightly curved hairs* are found chiefly at the distal joints; those of the tarsi (pl. V fig. 2 & 6) are the longest

and most slender, those of the patella and tibia are comparatively thick (pl. IV fig. 13). While it is impossible to define these two extreme forms of pointed hairs sharply from each other, there is in *Eucarus segmentatus* no connecting link between *„pointed"* and *„fan hairs"*. But in *Euc. Italicus* as well as in *Euc. Arabicus* (pl. IV fig. 14) there are very clumsy hairs bearing a distal terminal hair just like many fan hairs; it is impossible to distinguish these hairs from the extreme forms of fan hairs; on account of their position these clumsy pointed hairs must be homologized with undoubtedly pointed hairs in *Eucarus segmentatus.*

(2). The most typical *fan hairs* are well articulated flat hairs, broader at their tip than at their base; the distal margin is divided into a larger median lobe and two smaller lateral lobes: the median one often bears a small pointed „hair". They are provided with chitinous lines, single at the base but divided distally. These hairs, gradually merging into hairs four to five times as long, are broad at their tip (pl. IV fig. 12 & 13), straight or curved. Especially in *Eucarus Arabicus* there are hairs the distal margin of which is divided into many fine spines (pl. IV fig. 18). The three lobes are not always placed at the same level; in some hairs the lateral ones are bent more or less inwards. The fan hairs resemble the hairs of *Cheyletus ornatus C.* et *F.* as shown in Berlese's paper (1 Tab. 130).

(3). Along the dorsal side of the metatarsus of the second, third and fourth pair of legs and at the outer side of the fourth pair of femurs there are placed some hairs which are very similar to the *tactile* hairs of other Arachnids (pl. IV fig. 12). These hairs are very thin, strongly curved and placed in deep and large articulation-cavities. I name these hairs *sense hairs.*

3. The Mouth Organs and the Antennae etc.

A. Pseudocapitulum (Tab. IV fig. 3, 4 & 5).

General Remarks. The different authors do not agree with each other with regard to the interpretation of the mouth parts in the Acari. Some authors (Haller 7 and Oudemans 17) do not at all regard the Acari as Arachnids and are consequently unable to compare their mouth parts with those of the other Arachnids. Others and among those A. Michael (10) has neither taken part with the one nor with the other, while he is disposed to make a comparison with the Insects. Still others as Winkler (20), Brucker (3), Börner (4) homologize the different parts of the mouth organs with those of the other Arachnids, even if they do not agree in details; this last point of view is certainly the only correct one.

The most developed pseudocapitulum (f. inst. in the *Gamasidae*) is a tube formed by the fusing of the „rostrum", — which in reality is nothing but the front part of the head with the *maxillae.* In other Acari the „rostrum" is only a bridge covering the basal part of the antennae. In the *Bdellidae* (Michael 14) and *Noerneria* (Nordenskiöld 16) the antennae are uncovered in their whole length. The sides and the lower part of the pseudocapitulum are made of the maxillae fused with each other in the middle line. The palps are articulated with the maxillae, which probably are no other thing than their coxae. The distal part of the maxillae is mostly free and developed in a different manner in the different families.

The question if the ventral side of the pseudocapitulum is only formed by the maxillae or by the coalescence of the maxillae with a labium, has been answered in a different manner by the different authors. Brucker startes the theory that there exists a „*tégument post-oral virtuel*" (2 pag. 417), which in connection with his „*tégument supra-oral*" (basal part of the labrum) forms „*la trompe pharyngée*", including the pharynx; to prove this theory worked out into its consequences he advances more of common meditations than convincing facts. C. Börner (4 pag. 108) agrees in the principal points of view with the said naturalist, though his theory is founded on a more common arachnological base, making a comparison between the *Pedipalpi* and the *Acari.* Winkler who regards the

„Bauchtaster" of the *Gamasidae* as a labium, maintains consequently that only the maxillae and the labrum take part in the establishment of the pharyngeal tube. This last theory seems to me the most natural, though I admit that still more facts — chiefly embryological ones — are necessary to settle the question definitively.

Within the pseudocapitulum, and forming the ceiling of the *pharyngeal tube*, the *labrum* is found. I call this organ labrum, following the terminology of Dr. H. J. Hansen and W. Sørensen, though most acarologs have used other names (*rostrum, lingula* and *epipharynx*). The pharyngeal tube is established by the coalescence of the labrum and the maxillae, and is penetrated by the pharynx, which takes its origin where the labrum and the maxillae coalesce with each other. The antennae are articulated beneath the rostrum and above the labrum.

Shape in Eucarus. The pseudocapitulum (pl. IV fig. 4 & 5) is articulated to the „head" in a large cavity, the position of which is obliquely downwards and backwards, because the front part of the head projects as a semi-roof over its base, and the sides of the cavity being directed backwards and downwards. The articulation membrane permits movements in several directions chiefly up- and downwards. As in the other Acari the pseudocapitulum is composed of the rostrum, the labrum and the coalesced maxillae, and consists of two tubes, an upper, imperfect one including the antennae, and a lower one, the pharyngeal one.

a. *Rostrum.* The „rostrum" (pl. IV fig. 4 & 5 *r.* pl. VI fig. 1 *r*) only covers the base of the antennae and is itself covered by the front part of the head, on account of which it is thin and membranous. This organ which is identical with the „rostrum" in other Acari is by a fine impressed line divided into a right and a left part and is slightly granular. As will be seen in the longitudinal section (pl. VI fig. 1) it may be regarded as the dorsal part of a sheath formed by the invaginated antennae. It is coalesced with the base of the backwardly directed projection of the maxillae, and as it is so little developed the greater distal part of the upper tube is only a gutter. The bottom of the upper tube is formed by the labrum in the middle and at the sides by the inwardly directed parts of the maxillae coalesced with the latter; this bottom is almost flat behind, but in front it is strongly keeled (pl. IV fig. 5 *l* and VI fig. 5 *b*).

b. *Labrum.* The labrum consists of two pieces as in the *Phalangiidae.* The distal one (pl. IV fig. 6 *l*) is elongated and more narrow in front, where it is teethed (pl. IV fig. 8 *l*), and projects over the mouth. This free part is bent a little downwards (fig. 4 *l*). The distal piece is broadest just in front of the hindmost margin; the outer margins are slightly bent outwards. The proximal piece is much shorter; in front it is much narrower than the hindmost part of the distal piece, the margins are first slightly curved outwards, and after a slight bend they are directed obliquely outwards, so that the hindmost straight margin is as broad as the broadest part of the distal piece, and as broad as the proximal piece is long.

c. *Maxillae* (pl. IV fig. 4 & 5). As mentioned above the maxillae are coalesced along the middle line below; on each side they are provided with a large projection directed obliquely upwards and backwards (fig. 4 *b*), the free end of which is divided into a short front branch and a longer hindmost one; the hindmost margin is articulated to the head, and the base is united with the „rostrum“. Just in front of this projection the trochanter of the palps is articulated in a deep cavity. The ventral side of the fused maxillae is flat or slightly convex from one side to the other; distally it is bent slightly upwards. From the base to the tip a chitinous tube (pl. VI fig. 6 *tu*) is placed just under the skin, in front debouching between two *lateral lobes* just beneath the labrum. Near the tip there are placed two hairs in the middle; more outwards and behind four other longer or shorter hairs on each side. The end of each lateral lobe is directed inwards, so that the chitinous tube which is placed between them seems to be enlarged near its debouch. Each lobe is a little more elevated than the preceding part of the ventral side and is prolonged upwards to coalesce with the labrum,

surrounding the mouth in this way together with the latter. Along the inner side of each lobe there are placed two rows of teeth (fig. 8 *i*). More to the outward along the lateral margins of the mouth there are placed two other rows of which the exterior consists of about fifteen compressed teeth, united at their base; this row is directed obliquely backwards.

The maxillae bear in front two pair of organs:

1. The sides of the maxillae are terminated with an organ on each side, most similar to Winkler's „Lobi externi der Maxillen“ in the *Gamasidae* or Michael's „Maxillae“ in the *Oribatidae.* These *maxillary lobes* (pl. IV fig. 3, 4, 5 & 7 *m*) are articulated on each side of the labrum and are compressed, almost massive organs, slightly bent outwards. Their upper margin is curved a little downwards, and their tips form a little hook; the lower margin is provided with four teeth, one behind the other, and the last is much the largest.

2. Just below their base a very remarkable perpendicular thin plate is placed, fastened with a narrow stalk (pl. IV fig. 4 & 6 *p* and fig. 7). The front margin of this pentagonal plate is directed obliquely downwards and backwards and curled outwards, so that this margin seems very thick (fig. 7 *f*). The posterior and upper margin is curved backwards and provided with hair-like branches, four larger ones behind and many smaller ones in front. More or less parallel with the posterior margin some thickened lines (fig. 7, 1) are developed, at first sight giving the appearance to the hindmost, upper part of the plate of being only a hair. From the base to the middle of the plate and from the middle to the lower margin other thickened lines are developed (fig. 7, 2 & 3), so that the lower proximal part is sometimes similar to a separate plate.

More inwardly and downwardly there is placed a chitinous thorn, sharp and much like the edge of a knife (fig. 7 *s*).

B. The Palps (Tab. IV 9).

The palps are articulated to the pseudocapitulum in front of the above named projection. They consist of four free joints as the basal one is fused into or identical with the maxillae. The first joint (trochanter) is small, almost round and provided with two pointed hairs below. The second joint (femur) (pl. IV fig. 9 *f*) is enlarged towards its end. The upper side is provided with fan hairs, the lower with a single one. Besides there are short pointed hairs. The third joint (tibia) is a little shorter than the former and provided with few fan hairs and several pointed hairs. The last joint (tarsus) is the longest; a forwards bending line separates it into two parts, a proximal, longer one (fig. 9 *t*), and a distal, shorter one. The first part is provided with relatively few pointed hairs; the hairs of the second part are placed nearer to each other especially along the upper margin, their tips bending downwards. Some hairs on the under side bear distally two short branches. There are two claws.

The palps are almost as long as the pseudocapitulum and are carried in a downward-bent direction. The articulations between the maxillae and the trochanter and between the trochanter and femur give the forward, backward and lateral directions to the appendage. Between the patella and tibia there is a ginglymous articulation, which effects down- and upwards movements; the articulation between tibia and tarsus also permits a lateral movement.

C. The Antennae (Tab. IV fig. 4, 5 & 10).

This pair of appendages ought to have been dealt with before the pharyngeal tube, as this is partly formed of the basal part of the second pair of limbs, but as the whole pseudocapitulum forms one organ, including the antennae, I think it most correct to describe them here. Winkler (20 pag. 322) homologizes these limbs with the mandibles of the insects, on account of the suboesophageal origin of their nerves. No doubt he overvalues the importance of

this fact; if there were any close relation between the two orders it might perhaps be convincing, but their relationship has not yet been proved. I prefer to follow Drs. Hansen and Sørensen in their terminology, though with some hesitation, as such an eminent author as Michael (10 pag. 116) calls them mandibles.

They lie along (pl. IV fig. 4 and 5, pl. VI fig. 6) the labrum and are articulated under the „rostrum"; they consist of three joints (fig. 10) as usual in many Acari f. inst. the *Gamasidae*, and are placed near together with the exception of the distal ends which are more removed from each other. They are somewhat compressed. The basal joint (fig. 4, 1) which is shorter than the second and almost cylindric, is bent slightly inwards on the ventral side. It is provided with a single pointed inner hair near to the front and dorsal margin at the base of the second joint. The second joint is somewhat longer than the first one and articulated into a cavity of the latter, it forms the upper finger of the chela, the lower margin being bent upwards where the third joint is articulated, forming a terminal hook with the upper margin. It is provided with two dorsal hairs, a longer more distal one, and a shorter, more proximal one besides an inner hair near the dorsal margin between the two mentioned. The upper finger has at least one tooth behind the hook. The third joint (fig. 4. 3) or lower finger of the chela is articulated with a very well developed hinge-joint within a cavity of the second one; it is terminated with a strong upwardly directed hook, behind this there is a large tooth, sometimes several small teeth. The third joint of the antennae is moved by strong muscles. The adductors (fig. 10 *c*) are fastened to a strong tendon going from the upper corner of this joint into the first joint, where it is divided into several branches. The muscles connected with this tendon are especially fastened to the upper walls of the two first joints. The few abductors (fig. 10 *d*) are connected with a short tendon arising from the lower corner.

4. The Legs.

A. General Remarks.

The legs of the Acari have a different number of joints in the different members of the order. It is not always easy to identify the number of the joints, as the different authors differ with each other with regard to the definition of a joint. Some of them consider the part between two grooves as a joint (Kramer); according to others (Winkler) a joint must have its own articulation. The latter opinion is certainly very sensible, sometimes, however, it will lead to mistakes, f. inst. in *Norneria Canes.*, if you wish to homologize the joints of the different legs, as we will see later on. The acarologs differ in their opinions as to the number of the joints, and so they do in their interpretations.

There is another cause to difference of opinion namely the so-called epimeron (Michael 10 pag. 16). The epimeron is f. inst. very well developed in many *Prostigmata*; if we have before us such an animal as *Bdella*, no one would hesitate to regard the epimeron as a strongly chitinous portion of the sternum; but if we regard such a species as *Alicus* Koch (Berlese 1 Tab. 39) or *Caerculus* Duf. (1 Tab. 169), and if we remember that the coxae of the Opiliones are almost (*Opiliones Palpatores* Thor) or completely (*O. Laniatores* Thor) immovable, we are obliged to admit that there are important evidences of the coxal nature of the epimera. The coxae of *Eucarus* might be named in favour of the same interpretation. Some acarologs (Brucker) have been of the same opinion, others (Michael, Berlese) maintain that the first movable joint is the real coxa.

The legs of the *Gamasidae* consist of six joints, those of the *Oribatidae* (Michael) of five (6) joints; those of the *Ixodidae* of six, if we regard the epimeron as the first joint. The number of joints vary in the different genera of the *Prostigmata*. The genera *Penthaleus* and *Notophallus* Koch have only six joints which most naturally might be regarded as coxa (epimeron), trochanter, femur, patella,

tibia and tarsus. The first three pairs of legs consist of six joints in *Eupodes*, the femur of the fourth pair of legs is in *Eup. fusifer* R. Can. divided by an indistinct groove into a large proximal and a small distal part. In *Eu. variegatus* Koch the two parts are separated from each other by a distinct articulation (Berlese I Tab. 24—25). The fourth pair of legs in the last named species have consistently seven joints. The three first pairs of legs in *Norneria gigas* R. Can. consist of six joints; the femurs are divided into two parts by a groove; the fourth pair of femurs is divided into two joints by a distinct articulation. The legs in *Linopodes* Koch all consist of seven joints (not numbering the one tarsal piece) as the fourth pair in *Norneria*. The first pair is very long and slender and used as feelers. The three last pairs are shorter ambulatory limbs and by more or less distinct circular grooves their tarsi are divided into two pieces. The two last joints in the first pair being separated from each other by a ginglymous articulation and not by a mere groove as the two tarsal joints of the other legs, there is scarcely any cause to identify the penultimate joint of leg I with the proximal tarsal part of the other legs (Berlese 1 Tab. 26) or the fourth joint (pars distalis femoris) of the first with the tibia of the other legs. The basal part of femurs IV is by an indistinct groove divided into a very short proximal part and a much longer distal part. The legs in more developed genera as *Actineda* Koch, *Rhyncholophus* Dugès and *Trombidium* Fabricius, consist as in *Linopodes* of seven joints the femurs always being bipartite. The tarsi are sometimes provided with false articulations as in the *Phalangiidae* (*Erythraeus Hercules*) (Berl 1 Tab. 117) and *E. sp.* from Finland.

The legs of at least many higher Prostigmata are thus divided into seven joints, and the third and fourth joint of these correspond to the third in many other lower members of the same suborder. Such a division of the femurs into different joints is, as far as I know, only found in the *Chelonethi* outside the order of the Acari. In this order, as Hansen has made evident, we are able to follow the gradual development of this division from *Chiridium* to *Chtonius*;

Chiridium has an undivided femur; *Chtonius* has the distal part so very well developed that all arachnologs before Hansen have regarded it as the real tibia. The same development may be followed in the *Prostigmata* from a genus as *Notophallus* to *Ryncholophus*. I do not at all know if this character will get any systematical value here as in the *Chelonethi*, it will, however, be necessary to take it into consideration when dealing with the homology of the joints.

B. Legs in Eucarus (pl. IV fig. 1—3, pl. V fig. 1—6).

The legs of the *Notostigmata* are very singular. They resemble the legs of *Linopodes* as the first pair is much thinner and longer than the other and probably used as feelers; the fourth pair is stronger than the second and third. Leg I and II are directed forwards, the two last pair are directed backwards. Though there is great difference between the first and the three last pairs of legs, it is easy to show that they are shaped after the same form. They consist (pl. V fig. 1—5) of a *coxa*, *trochanter* (a) (one or two), *femur* (b), *patella* (c) (I call this joint patella on account of its position between the femur and the tibia), *tibia* (d), *metatarsus* (e) and *tarsus* (f). The tarsus is sometimes by a circular groove divided into two parts and terminated with a claw-joint.

All the coxae (pl. IV fig. 3) are small round movable joints; the first three pairs are covered by projections from the sides of the cephalothorax; the last pair is a little more elongated and not covered by any projection. The trochanters of the first two pairs of legs are undivided; that of the two last pairs is divided into two joints.

The coxae and the one or two trochanters have universal articulations which permit the appendage to move in forward, backward and lateral directions. The articulation between the femur and the trochanter is a ginglymous one, having its main motion upwards, serving to change the direction from the more or less horizontal to one approaching the perpendicular. This upward movement is supported

by the structure of the proximal part of the femurs which are divided by a groove into a short proximal and a long distal part, forming an obtuse angle with each other, so that the distal part is directed more upwards. This is much more prominent in the first pair than in the others, where it is more or less indistinct. The difference between the legs in this respect can be explained by the special function of the first pair. The articulations between the femur and the patella and tibia are ginglymous articulations with the main direction downwards. The patella, which is always shorter than the tibia, serves to change the more or less perpendicular direction to one approaching the horizontal. The tibia serves to change the direction to a more or less perpendicular one, so that the tarsus may reach the ground. The articulation between the tibia and the metatarsus is more universal than the last named, as it permits movements in several directions; this is most prominent in the first pair of legs. The articulation between the metatarsus and the tarsus of the first pair of legs is very little developed, while the corresponding one in the last three pairs resembles the articulation between tibia and mesatarsus of the first pair.

If the first and the last pair of the legs be compared with each other, it might perhaps at first sight seem natural to identify the proximal part of the first femur with the trochanter second of the fourth pair. But when we observe that there is no articulation between the two parts of the first pair of femurs and that the articulation between the trochanter and femur is a ginglymous one, while the one between the trochanter first and second is universal, and last but not least that also the trochanter second is undivided, there can be no doubt about the homology between the trochanter I and the two trochanters IV. Add to this that the last pair of femurs show vestige of a proximal femoral part (pl. V fig. 1—5).

Leg I (pl. V fig. 1). The relative length between the joints is different from that of the last three pairs. The *coxa* is short, almost round, and provided with few pointed hairs below. The *trochanter* (fig. 1 *a*) is almost cylindric and three to four times as long as high.

It is slightly pointed in front, and the proximal part of the dorsal side is curved downwards, because the basal upper point is directed upwards. The joint is provided with comparatively narrow fan hairs below and along the sides; there are very few pointed hairs. Above there are only few fan hairs. The *femur* (fig. 1 *b*) is seven to eight times as long as high and is composed of two pieces, a proximal short one (b^1) and a distal long one (b^2). The two pieces are separated by a distinct groove. The lower margins of the two pieces are curved upwards and merge into each other, only marked by a slight groove. The upper margins form an obtuse angle with each other, by which the more upward direction of the femur is assisted. Between the trochanter and the femur there is a very well developed ginglymous articulation. As there is no articulation between the two pieces, and as there are no muscles to move them towards each other, they must be regarded as one joint; compare with this the proximal femoral part in the *Prostigmata*. The distal piece is enlarged towards its point and its upper side is somewhat curved downwards. The sides are provided with a row of thin, mostly hairy fan hairs, the dorsal side with rows of many pointed and few fan hairs. Below there are pointed hairs and fan hairs, the former more outwardly. The *patella* (fig. 1 *c*) is enlarged towards its point. The direction of the joint is not exclusively perpendicular but also slightly lateral. The sides are provided with fan hairs, the dorsal and ventral side with both fan hairs and pointed hairs. The *tibia* is as long as the femur but more slender, and by a circular median incision it is divided in two pieces. The upper side is curved downwards. The front side is provided with a row of pointed hairs, the hindmost with pointed and fan hairs. The dorsal and ventral margins are provided with many pointed and few fan hairs. A dorsal and a ventral hair are usually placed opposite to each other. The *metatarsus* as well as the *tarsus* are short and little developed compared to those of the other legs. They are provided with long, slender pointed hairs; the metatarsus bears near its base a dorsal, triangular pointed hair. Near the point of the tarsus there is a

longer, straight dorsal hair. The two claws are only slightly curved, and there is no claw-joint (pl. V fig. 2 *t*).

In most of the specimens that I have examined the first pair of legs were carried in a more or less backward and upward direction along the back; as the trochanters were directed forwards, the other legs are always directed towards the ground. Because the first pair of legs are carried in the said manner, and on account of several structural differences between this and the other legs, it is most natural to regard the first pair as feelers more than as ambulatory appendages. The first pair of legs are much more long and slender, the proximal piece of the femur is well developed and accordingly promotes the upward direction, the articulation between the trochanter and the femur has a well marked upward direction. The claws are only weakly developed, and there is no movable claw-joint.

Leg II, III, IV (pl. V fig. 3-5). The three last pairs of legs are shorter and stronger than the first. The trochanter II of the second pair is always missing. The proximal piece of the femurs is only marked by a dorsal incision. The femurs are more or less perpendicular in most of the examined specimens, the distal part of the legs is directed towards the ground and almost reach to it. The patella always bears a dorsal median row of pointed hairs. The tibia is always provided with a median dorsal row of pointed hairs and a long terminal thick and stiff hair. The dorsal side of the metatarsus bears strongly curved „tactile“ hairs. The arrangement of the other hairs varies somewhat in the different species; the fan hairs are mostly longer and more slender at the distal joints with the exception of the tarsi, where as a rule they are missing; the longest are found along the dorsal margins in the fourth pair of metatarsi.

The *femur* (b) is always longer and thicker than the other joints; the *patella* (c) is always shorter than the three last joints; the patella and the femur are enlarged towards their tips, the *tibia* (d) is almost cylindric, while the *metatarsus* (e) and *tarsus* are more or less pointed. The *tarsus* (f) is always divided by a groove into two movable pieces, a short, distal piece, and a longer proximal one. The distal piece terminates in a well developed *claw-joint* and is provided with a long straight dorsal hair (pl. V fig. 6 *t*). At the base of the claw joint there is found, at least sometimes, two plumiform hairs (*Eucarus segmentatus and Italicus*) (fig. 6 *p*). The lower edge of the claw joint (pl. V fig. 6) is more or less straight, while the upper edge is bent upwards and more or less toothed in the middle. There does not seem to be any areolum, at least not in *Euc. segmentatus* and *Italicus*. There is a well curved claw on each side articulated to a chitinous piece to which an upper levator tendon and a lower supinator one are fastened. The claw-joint is provided with a long upper curved hair (fig. 6 *u*) and a lower and more straight one (fig. 6 *l*) on each side.

The second pair of legs are a little shorter than the third, and much shorter and thinner than the fourth pair. There is only one short trochanter which is provided with a large, dorsal tooth directed upwards and backwards, the front end of which merges into the dorsal side of the trochanter, while the hindmost edge is perpendicular. The third pair of legs have the trochanter divided into two joints each of which is shorter than the one in the second pair of legs. The first trochanter is provided with a dorsal tooth, while the shorter second one has none. The fourth pair of legs are both longer and stronger than the two preceding ones; the two trochanters are cylindric, long and slender, the first one a little shorter than the second.

5. Respiratory Organs.

The breathing organs are tracheae starting from four dorsal stigmata placed in the first, second, third and fourth abdominal segments (pl. IV fig. 2 *s*, pl. V fig. 13 *s*). The position as well as the number of the *stigmata* are very singular. „*Dorsal*“ stigmata are, as far as I know, only found in the *Prostigmata*, but here they are

placed at the base of the antennae. Most of the Acari have only one pair of stigmata, the *Oribatidae* which bear four pairs proceding from the „acetabula“ of the legs, (Michael 10 pag. 171), excepted. The stigmata are placed in a curve in such a manner that the first pair is placed near the lateral margin. The second pair is placed more inwardly where the lateral longitudinal band is divided into two branches; the third pair is placed still more inwardly and the fourth a little more laterally.

The *stigmata* seem to have the following structure. They are more or less oblong and limited by a strong chitinous bar. The surrounding skin is provided with more or less circular folds. The stigma itself is covered by a more or less complete chitinous roof, arising from the wall; it is a short tube the bottom of which is a thin plate with many small pores. This tube is continued into a terminal narrow part of the tracheae.

The *tracheae* are extremely fine and difficult to follow in their whole length; I have not been able to do so in the material at my disposal. Especially the cephalothorax and the muscular sac of the intestine are interwoven with a great number of tracheae. I have always found a spiral structure, fine but distinct. The lumen decreases very slowly, they never anastomose but are provided with dichotomous or other furcations. Two trunks proceed from the first pair of stigmata; the one bifurcating near its origin, is directed forwards; the other lateral trunk emits a bifurcated branch backwards. Besides these two there is a much stronger bifurcated branch directed in- and backwards. The inner branch is directed towards the stigma III, the outer one emits two branches. The trunk arising from the second pair of stigmata is directed forwards and is in the second thoracic segment divided into two branches each of which is bifurcated. From the wider base a thinner branch is directed backwards. The tracheae starting from the third pair of stigmata, placed near the inner margin of the outer longitudinal muscular band is almost as strong as the inner branch arising from the first pair of stigmata; it advances without any branches forwards to the front margin of the thorax. The trunk is extended near its origin and here provided with a thin branch directed backwards. The tracheae of the fourth pair consist of an inner and an outer trunk, both bifurcated.

6. The Musculature.

Skin Muscles. The high development of the cutaneous muscles is very interesting, as it has scarcely been observed in any other Acarid; perhaps it corresponds to the segmentation of the abdomen. Each muscular band consists of one or mostly of several rather short „muscles" going from one group of muscular spots to the other; each muscle is composed of one or several strings, extended from one muscular spot to the other and consisting of a great number of delicate fibres. Almost all the muscles of the abdomen are cutaneous, as there are none dorso-ventral muscles as usual among the Acari; those of the cephalothorax take their origin from the cuticle or the endosternum and go to the appendages.

The main arrangement of the abdominal muscles is the following (pl. V fig. 13).

From the groove which distinguishes the caput from the thorax, a broad band arises on each side which is continued to the anal hill (fig. 13 l^1). This band, the *longitudinal interior dorsal band* becomes more and more narrow posteriorly towards the seventh segment, as each muscle here only consists of few strings, but thereafter it gets broader again and is directed inwards so that the right and the left band are almost united to one. In the tenth segment the band is fastened to the base of the anal hill and is probably used to draw the two anal valves nearer to each other. This longitudinal median band is divided into two parts in front, the outer and thinner of which is extended into the second thoracical and first abdominal segment, while the inner is fastened to the groove between the head and the thorax. This arrangement of the muscles proves that the two thoracic tergites are to be distinguished from the head. The *longitudinal exterior dorsal band*

(fig. 13 l^2) goes as the inner one from one segment to the other. It gets much narrower posteriorly, is bent inwards in the second to the fourth segment and is divided into two branches in the second segment. Where these two branches are fastened in front, I was not able to see; the band seems to terminate in the ninth segment.

The following system of lateral and partly ventral muscles has no connection with the two longitudinal dorsal bands. In front, behind the genital opening there are some muscles which are well separated from each other below but more united above (fig. 13 t^1); behind these there is a foremost narrow and a hindmost broader band, each consisting of one muscle; these two bands are well separated from each other below, but above they are united with each other and with several other bands (fig. 13 t^2). Behind these there are six *transverse lateral bands* of which the three first at least consist of two muscles below, a short one directed forwards (m^1) and a longer one directed backwards (m^2) and besides two above directed backwards and in prolongation of each other (m^4 and m^5). Where the dorsal and ventral parts are united there arises a muscle (m^3) which is extended to the muscular spots where the two dorsal muscles (m^5 and m^4) of the preceding transverse band are meeting, and between the last mentioned muscular spots and the upper tip of the preceeding band (m^5) a similar transverse muscle (m^6) is extended. In the first transversal band it is difficult to unravel this structure above on account of the very short muscles and the number of those arising here. The upper connecting muscle (m^6) between the third and fourth transverse band is missing. The fifth and sixth band have neither communication with each other nor with the fourth band, and the upper muscle (m^5) of the dorsal portion is missing. The hindmost ventral muscles of the first and second transverse band are connected with each other and with the short band in front by a thin *ventral longitudinal band* (l^4).

The upper dorsal muscles (m^5) of the first four bands are connected with a longitudinal muscle (m^7) that is very narrow between the third and fourth band. Besides the three first bands are connected with bands (c^2—c^4) directed upwards and backwards; the ends of these bands are united with each other by the *lateral longitudinal band* (l^3). This band terminates in a muscular spot behind the sixth transverse band and is connected with the upper ends of the two short bands (t^2) in front of the first transverse band by a broad band (c^1) directed upwards and somewhat backwards. Where this band is united with the upper part of the first transverse band, and where its two muscles are united, a thin muscle (*f*) is directed forwards and downwards. In front of and along with the genital opening there is a transverse band fastened to the sternum (*mg*). To the copulative sucker is fastened a muscle (*mc*) the origin of which I have not seen.

The anal hill, consisting of a right and a left part, is provided with a broad muscle fastened to its base and corresponding with the dorsal constrictor. At the sides there arise two smaller muscles fastened to the base laterally and opening the vent. From the base to the outer margin of each valve muscles are extended that no doubt have the function to invaginate the outer part.

Endosternite. Another interesting part of the muscular system is an organ which seems to correspond with the endosternite of most of the Arachnids; it is only found in a few Acari. Between the part of the oesophagus which lies behind the brain and the hindmost part of the suboesophageal ganglion there is a narrow transverse tendon. This tendon grows thicker towards the sides and is enlarged to a rather flat funnel on each side, the upper part being separated from the lower and directed obliquely upwards or downwards. This funnel is much more developed than the median tendon, being extended both backwards and especially forwards, as a muscular plate on each side of the brain. The margins of this lateral funnel or plate are continued into tendons which probably are connected with muscles. The plate is only provided with few nuclei. Where the funnel is separated from the median tendon there is a lumen provided with distinct nuclei (pl. VI fig. 7 & 8 *en*). The lumen of this elongated funnel is filled with a twisted gland (coxal gland).

7. The Nervous System.

The nervous system is very concentrated as in most Acari and Araneae, the ganglions being fused into a single one in the cephalothorax. There is no distinction between the supra- and the suboesophageal ganglion, as the commissures are broad and short. The „brain“ thus becomes one single mass pierced by the oesophagus (pl. VI fig. 1—2 *n*), higher in front than to the back. A transverse section (pl. VI fig. 7 *n*) through the brain in front shows that the organ here is almost twice as high as broad. Behind the supraoesophageal ganglion it is much broader than high. The brain is placed in front and below, just above the sternum. In section I have seen the nerves to the ambulatory appendages and most distinctly the maxillary and antennal nerves, the latter seem to arise from the commissure. The cortical layer of deep-staining cells is very well developed, chiefly in front and below. Behind, in the upper curvature of the brain, there is no cortical layer (fig. 1 *n*).

8. The Alimentary Canal.

The mouth is placed at the tip of the pseudocapitulum under the free part of the labrum. Just under the mouth, between the two small lateral lobes and merging into it, a chitinous tube arises which may be followed along the lower side of the pharyngeal tube to its base. The pharynx and the oesophagus are not sharply marked off from each other. The first part within the pharyngeal tube is most naturally called the pharynx; the remaining part which penetrates the brain and debouches into the intestine, the oesophagus.

The *pharynx* (pl. VI fig. 5 *p*) is a narrow chitinous tube, at least in front tricarinate and thus similar to that found in *Haemogamasus* (Michael 11 p. 310 pl. 35 fig. 73). One keel is directed downwards, the two others upwards and outwards. More proximally each keel is divided into two short ones, but it is always easy to distinguish the three main parts in transverse sections. The pharynx is provided with dilatores (fig. 6 *di*) which extend between the pharynx and the inner walls of the pharyngeal tube. The front part seems to have only two dilatores, the hindmost part six. A longitudinal section shows a number of about twenty dilatores. Circular constrictores extend from one keel to the other (fig. 6 *ct*). The oesophagus penetrates the brain (fig. 2) and is then directed upwards and backwards running between the two coeca of the intestine before discharging into it. The walls of the oesophagus are folded and provided with constrictores. I have not seen dilatores. The quality of the food which seems to be solid, as well as the structure of the mouth make it evident that the pharynx must not be regarded as a sucking-organ.

The intestine which fills the main part of the abdomen, has a comparatively complicated structure which I have not been able to understand in details, as my material was badly preserved both for sections and dissections. The intestine can be divided into three parts. „The *ventricle*" (fig. 2, 3, 11 and 12 *ve*) is a large sac, filling a great part of the abdomen, it is continued into a lateral narrow „*small intestine*" (fig. 2 & 12 *j*) of the same histological structure. The latter is enlarged behind and fuses with the „*colon*" (fig. 2 & fig. 12 *co*) in front continued into a large coecum and behind into the *rectum* (fig. 3 *re*) or *anal gut*, communicating with the vent.

The ventricle is a spacious hollow sac whick seems to have no coeca with the exception of a short one on each side of the oesophagus. The inner surface, chiefly in the front part, has sometimes well developed folds in the lumen. It is difficult to discern the cells from each other, chiefly in front, where the nuclei have disappeared more or less, no doubt on account of bad preservation. The cells are of different height, as seen in the sections (fig. 11); the proximal part of the cells is filled with small granules, the distal often with something which seems to be food in digestion. The cells of the hindmost part of the ventricle and those of the

small intestine are provided with distinct round nuclei (fig. 2). The foremost part of the ventricle, especially its two coeca, is provided with a comparatively great number of brightly coloured glandular cells (fig. 2 *z*), each of which is more or less elongated, provided with a large nucleus at its base and has the distal part filled with granules of secrete. On the inner side of the colon there is, as usual, a single layer of higher or lower epithelial cells with indistinct nuclei; besides these there is a great number of glandular cells, most like those of the anterior coeca, but shorter; when they are filled with globules of secrete (fig. 12 & 13 *z*), their ends are often much broader than their base. The walls of the short rectum consist of a low epithelium with distinct nuclei (pl. VI fig. 2).

The intestine is enveloped in a muscular sac (pl. V fig. 12) the muscular bands of which are crossing each other in all directions but mostly under almost right angles. The spaces between the bands thus become more or less square or rectangular and are usually much larger than the bands but sometimes will become very narrow as the bands are placed nearer to each other. Between the bands are small elongated nuclei and a thin layer of fibrous tissue which may naturally be regarded as the tunica propria of the intestine. A corresponding muscular sac seems to surround the accessory glands of the male. A similar system of muscles is found in the *Oribatidae* (M i c h a e l 10 pag. 150. Pl. E fig. 10), where the arrangement is more regular and the transverse striae of the bands easily seen.

The ventricle often contains Gregarines (?) as internal parasites. These are often provided with a single nucleus and are sometimes placed with the head into a cell. There seems to be two kinds, the one is $0{,}06^{mm}$ long and provided with a large round head ($0{,}008^{mm}$) the other kind is $0{,}24^{mm}$, merges into a thinner tail and is terminated with a head as broad as it is long and connected with the body by a thinner neck. The cavity of the ventricle is filled with round bodies ($0{,}02$—$0{,}06^{mm}$) consisting of a thick wall and an inner protoplasmatic mass. The wall is of a rayed structure or spiked; the contents sometimes come out through one to three openings. The colon mostly contains a large black faecal mass, consisting of the named bodies without contents and clear strings, probably of vegetable origin. I have asked several botanists about the nature of these bodies, and they either regard them as pollen grains or as spores of fungi.

9. Excretory Organs, Glands etc.

The Excretory Tubes. These are placed along the dorsal part of the intestine from its front- to its hindmost part. In the males they are placed along the testes, but more laterally than those. In the females they are placed along the oviducts (pl. VI fig. 2, 3, 4, 10, 11, 12, 17 *e*). I was not able to trace any communication between their hindmost part and the intestine behind; in front they are directed downwards and inwards, and in sections they are seen under the two short anterior coeca on each side of the oesophagus (fig. 2). Their walls are comparatively thin with few, rather large, oval nuclei. In their whole length they always contain smaller or larger bodies which are strongly coloured with hæmatoxylin (fig. 17 *u*) and show a more or less lamellar structure; these bodies are probably concretions of urates and are of different size, the largest more oblong (0,068^{mm} long and 0,044^{mm} broad) the smallest round (0,012^{mm}). If these tubes really communicate with the intestine, they are certainly homologous with the Malphigian tubes of other Arachnids, but I have never seen concretions in the gut, which seems to speak against any communication.

The Antennal Glands. Under the dorsal side of the cephalothorax and between the muscles of the antennae there is a glandular tube on each side, beginning in the front part of the abdomen and terminating near the base of the antennae (pl. VI fig. 1 & 7 *a*). The tubes are amplest behind and in the middle; in front they become much more narrow. Their ends are somewhat swollen and directed upwards like a hook. Whether these tubes are closed or

whether they discharge here I have not been able to investigate. The spacious cavity of the tubes is covered with a single layer of epithelial cells, the limitation of which is not distinct, but which are provided with round basal nuclei; there is a thin tunica propria.

The Maxillary Glands. On each side of the above mentioned glands there is another pair arising near the dorsal surface and directed towards the base of the pharyngeal tube (pl. VI fig. 2 and 7 *b*). This pair is longer than the antennal glands, and its hindmost tip is placed more backwards than the point of the former. These glands are cylindric and much larger than the above named. They seem to consist of a clear or vitreous mass which is divided into larger and smaller meshes by strings, distinctly seen when coloured by hæmatoxylin. Distinct nuclei are placed along the margins; I have not been able to find any lumen in these glands. On account of their direction towards the base of the pharyngeal tube I regard them as salivary glands and call them the maxillary glands.

The Coxal Glands. In the lumen of each muscular funnel and fastened to its walls by short strings a strongly twisted glandular tube is placed (pl. VI fig. 3, 7 *d* and fig. 15) which seems to be continued into a duct directed towards the first or second pair of the coxae. I am certainly not able to prove that the different tubes which are seen in sections, are parts of a single tube, but this seems to me the most probable. The histological structure of this gland is very much like that of the coxal glands in other Arachnids as described by Lancaster and Sturany (18). The walls consist of a single layer of cells which merge into each other. The nuclei are placed near the lumen; I have not seen the same difference between the basal and the distal part of the protoplasma, as found in many other Arachnids. On account of their structure and position I think that these glands are homologous with the coxal glands.

The Horse-shoe Glands. Along each side of the cephalothorax there is a gland most like an elongated or compressed horse-shoe, the limbs of which lie over each other and are terminated into the hollow of the first pair of coxae, perhaps taking their origin here (pl. VI 7 & 8 *c*, fig. 14). Whether the said glands are tubes or solid bodies, I have nor been able to investigate with certainty. At least they consist of a great number of nucleated cells and are shaped completely differently from the coxal glands; on account of which I do not identify them with coxal glands.

Glandular Ducts. I prefer to describe here a singular system of chitinous tubes which connect the mouth with the first pair of the coxae, because they are probably glandular ducts, perhaps those of the said glands. These ducts begin (pl. IV fig. 19 *t*) at the hindmost part of the first pair of coxae right under the sternum with a swollen part; the finely granular walls of which are partly covered by chitinous prolongations from the coxae (*c*); each tube grows thinner and is directed inwards and forwards, so that the two tubes touch each other and discharge into a common duct (*g*). This common duct is mounted with many thickenings, the one facing the other and connected with distinct chitinous rings. The meaning of this ringed structure is certainly this, that a stiff tube is avoided, which would incommodate the flexibility of the articulation membrane of the pseudocapitulum, where it is placed. This ringed tube is continued as (pl. VI fig. 6 *tu*) a stiff one along the floor of the pharyngeal tube, finishing here between the two small inner lateral lobes.

Heart. In the front part of the abdomen along the back of the ventricle and between the inner longitudinal bands there is an elongated thin-walled and narrow tube. Its position makes it natural to regard it as a heart; the material at my disposal is not sufficient to settle the question; I have only seen it in longitudinal and transverse sections.

Clear dorsal Sack. Closely under the dorsal skin and very often visible through it as a clear spot a hollow body is placed a little pointed behind; it is coloured with hæmatoxylin, but I cannot see any nuclei. It seems to be chitinous (pl. VI fig. 2 & 10 *m*).

Epidermis. The epidermis is always very well developed; the different cells are very visible seen from the inner side and provided with small oblong rather irregular nuclei. Between these there are round cells with a large round nucleus; these are probably glandular cells. At least in some specimens I saw clear vacuoles arranged around the nucleus.

10. Sexual Organs.

The females and the males are always, at least in my specimens, very eas to distinguish from each other. The female possesses a large ovipositor, and even if this is invaginated, it is recognisable by the oviduts and eggs seen through the skin; the male is always easily known by a complicated system of accessory glands under the skin behind the genital opening. The genital opening in both sexes is placed between the third pair of coxae, and on each side there is placed an oblong movable, strongly raised body provided with one slender pointed hair and five hairs bearing spines (pl. V fig. 8, 9, 11 & 13 *c*; fig. 10). This body is in reality a valve articulated to the skin in front and at the sides, but with the hindmost and inner margin free, so that it may be raised and a glandular mass poured forth; the valve is closed by a separate retractor muscle (pl. V fig. 13 *mc*). These organs correspond perhaps to the so-called „copulative suckers" that are found in different forms in other Acari.

The Male Organs (pl. VI fig. 2, 3, 4, 8, 9, 10, 16, 17, 18 & 19).

The Testis. The most peculiar part of the male organs is a complicated system of accessory glands. The testis and their ducts have been very difficult to examine, and I have been obliged to let important questions remain unsolved. Along the back of the intestine, parallel with the excretory tubes (*e*) but more inwards the testes (*t*) are placed going from the anus to the foremost part of the ventricle. They form two bands, getting more and more narrow from behind and forwards and consisting of a large number of cells;

the cells are arranged in meshes or thinwalled tubes, which are most numerous behind. There are many different stages of these cells; some of them are round and provided with an oblong nucleus, others, certainly spermatozoa, consist of an irregular terminal nucleus and a kind of a tail. In well preserved material it would most likely be easy te follow the development of the spermatozoa in details. The „testes" are probably directed downwards in front and discharge into a bifurcate ringed sac before the „vestibule" (fig. 3 & 8 *v*) which is filled with spermatozoa (fig. 2 & 8 *pe*; fig. 16). Besides in this one there is only found spermatozoa in the hindmost part of the testes. The relation between the oviducts and the testes and their structure must be referred to the investigation of those who have better material at their disposal.

The Accessory Glands. The accessory glands (fig. 2, 3, 4, 9, 10, 18 & 19) are very well developed and are placed just under the skin behind the genital opening, filling a great part of the abdomen. There are two pairs of glands and a single undivided one which all seem to debouch into the „vestibule". The *median unpaired gland* (*g*) is a long hollow sac, chiefly in front combined with the ventricle, the lateral and median paired glands. The upper part of this sac is by a fold from its upper wall divided into a right and a left part. The lateral parts of the lumen are somewhat flattened in front in contrast to the median raised one, as these lateral parts are below and above covered by the median and lateral paired glands (fig. 9). This unpaired gland is connected behind with a pair of round glands, always visible through the skin. These the *hindmost paired glands* have very thick walls and a narrow cavity in connection with that of the median gland (fig. 2, 3 & 10 *i*). The walls of these glands consist of several layers of cells, mostly only marked by distinct nuclei. Just below the foremost part of the unpaired gland there is on each side an elongated body with narrow lumen, the *anterior median paired glands* (fig. 3, 9 *h*). It seems most probable to me that all these organs are glands, though their histological structure is not completely convincing.

The glands mentioned here are enveloped in a muscular sac. The *paired lateral glands* which (fig. 3, 9, 10, 18 *f*) are visible in their whole length through the skin, arise before and above the median sac and thereafter are placed along the side with the exception of the hindmost part behind the median glands. This is directed to the inner side and often cross that from the other side between the anal hill and the hindmost median paired glands (fig. 18). The cells of these very spacious glands are evidently glandular; each cell containing a nucleus and globules of secrete. The lumen of the gland is filled with these globules. The accessory glands as well as the above named bifurcate organ seem to discharge into a flat „vestibulum". The genital opening (pl. V fig. 13) is a transverse split placed between a foremost (*gf*) and a hindmost (*gh*) plate, both movable by thin articulation membranes; the front one is longer than the hindmost, which is short but broad.

The Female Organs (pl. V fig. 7, 8, 9, 10, 11. Pl. VI fig. 11, 12 & 13).

The Ovaries etc. I have not been able to understand the structure of the ovary nor to find the cells from which the eggs arise. Behind, along the sides and above the intestine there is a great number of eggs at different stages of development; most of them seem to lie between the excretory tubes and to be more developed in one side than in the other side. The young eggs are provided with a distinct nucleus and nuclear body; between them there seem to be bands with small nuclei; the condition of my material has not made it possible to investigate the structure of these bands or their relation to the formation of the eggs. The protoplasma in the eggs gets partly transformed into small yolk balls especially in the largest, where only a little of the protoplasma is left unchanged; the nucleus is only very little and difficult to discover in the fullgrown eggs. In sections I have seen narrow tubes with thick walls (fig. 13 *g*) and small nuclei among the eggs. Similar tubes are also found in the males(?). The *oviducts* (pl. V fig. 11 *o*; pl. VI fig. 11 *od*) are long narrow tubes which lie along the sides closely connected with the muscular layer of the intestine. Their point is directed downvards and inwards to reach to the ovipositor into which they discharge (pl. V fig. 11). In the angle between the indrawn ovipositor and the oviducts there is an *oblong hollow sack*, the comparatively thick walls of which consist of cells with distinct nuclei (pl. V fig. 11 *g*). Where the oviducts discharge into the ovipositor there is a little pocket directed backwards (fig. 11 *h*). The walls of the oviducts are provided with a layer of distinct circular muscles.

The Ovipositor. The ovipositor itself is a short clumsy organ that may be fully invaginated into a sheath by a pair of muscles (pl. V fig. 11 *i*) so that it is completely received into the abdomen. When protruded the ovipositor is directed obliquely forwards and downwards and is provided behind with a hairy little median hill (fig. 9). Near the tip the inner upper wall is provided with a three-branched process (fig. 7, 8, 9 *s*), the two lateral larger branches of which are directed outwards, while the smaller median one is directed forwards. When seen extended and from the side it is almost stalked, as the distal part is very much enlarged.

11. Concluding Remarks.

I have called the *Notostigmata* a suborder of *Acari*, and this interpretation seems to me to be the most natural, though I am not quite convinced about the systematic unity of this order. Such a doubt by one whose knowledge in Acarology is comparatively small, is perhaps a little surprising, when a first-rate zoologist as Michael (10 pag. 27—49) discusses the natural relation between the different forms without restriction; but if we remember, that even Michael himself is not able to give a proper definition of the Acari (12 pag. 21), and that the order has a long tradition, originating in a time when it was not possible to grasp with them in a completely scientific manner, it will certainly be found natural or at least excusable, to set forth doubts and eventually start a discussion.

The following features seem to be common to most of the Acari, and they are not yet found in other Arachnids, viz: that they have a three-legged larval form, and that there is an inert stage before each ecdysis (Michael I p. 195). These two points of similarity are certainly very important, but it seems to me that they are not sufficient for a quite sure foundation of an order. A number of other characters are common in a higher or smaller degree to the different members, but from different causes they are not important enough to settle the question.

1) There are points of similarity in the shape of the mouth organs. The maxillae are fused with each other and sometimes with the labrum; we have often a movable pseudocapitulum, formed by the fusing of the maxillae with the rostrum. Only the first of these characters is common to all Acari, but it is also found in the *Pedipalpi* and the *Cryptostemma*. But as the mouth organs of the *Gamasidae* and *Ixodidae* are just as different from each other as those of the *Gamasidae* and *Pedipalpi* (comp. C. Börner 4), they do not prove the systematic unity of the Acari.

2) With regard to the chela of the antennae and other appendages Oudemans (17 pag. 46) „fand dass, wenn .... Acarina Scheeren haben, der digitus mobilis innen oder oben liegt..." and resumed his results as follows (p. 45—46) „Ich habe .... gefunden, dass der digitus mobilis bei allen Arachnoidea und bei Limulus aussen oder unten, bei allen Crustacea dagegen innen oder oben liegt, ganz gleichgültig von welchen Extremität man die Scheere nimmt". But many Acari, f. inst. *Gamasidae* and *Oribatidae*, have a chela with a lower movable finger, and as thus the base for Oudemans' theory is wrong, no further discussion of this matter seems necessary (comp. Wagner 19 pag. 148).

3) Most authors agree in the theory that the body of the Acari falls in two distinct parts, separated by a groove behind the second pair of legs, and they are certainly right; the absence of this groove in many full-grown Acari (most *Gamasidae* and *Oribatidae*) does not weigh much. But the theory of Dr. Sørensen, involving

that this distinction between the „*head*“ and the „*thorax*“ is a common arachnological character, makes it impossible to use this fact in the definition of the Acari.

4) One of the most stricking features in the Acari is „Abdomen fused with cephalothorax and body unsegmented“. After a long discussion about this theme Michael says (12 p. 21) „The fact seems to be that the proper definition of the Acarina (treating that word as including all the Mites) would be „Abdomen fused with the cephalothorax, or united to it by almost the whole breadth“; but if that be adopted, what becomes of the book definitions of the difference between *Acari* and *Phalangiidae?*“ And not only *Phalangiidae* but also other Arachnids (f. inst. *Chelonethi*) especially when we regard such a segmented form as *Eucarus*.

5) The absence of tracheae, heart, coxal glands and endosternite in many Acari has scarcely any systematic importance in giving a characteristic of all Mites. The concentration of the nervous mass is also found in the *Araneae* and *Chelonethi*.

According to Wagner the two last named groups of facts are only a consequence of their degeneration or more correctly of their degradation from higher Arachnids. Other systems of organs differ in a surprising degree in the Acari, f. inst. the breathing, excretory and digestive organs; this circumstance is more suitable for separating than for uniting the different Acari.

The question before us, whether the different suborders form a natural group or not, will probably first get its definitive solution, a universal comparaison between the different forms based on all features of systematic importance being undertaken.

If these doubts are founded, it must consistently be the wrong way to compare the Acari as a whole with other Arachnids or Arthropods; the different authors have also arrived at very different results from this base. Haller's (7) and Oudeman's (17) theory that the Acari are not Arachnids has been refuted by Wagner (19) who — and probably rightly — like most other naturalists regards the Acari as degraded Arachnids. The Finnish

naturalist Dr. E. Nordenskiöld starts in an interesting paper (15 pag. 51) the theory „dass die höher organisirten Acaridenformen sich von den tiefer stehenden selbständig entwickelt haben“; this theory, consistently followed, seems to me to involve the derivation of the higher Arachnids from the Acari, granted that we regard the Acari as Arachnids. I think that very few naturalists will be inclined to accept this view.

Returning to our original subject after this long transgression, we have to investigate if the *Notostigmata* bear any relationship to the one or the other suborder of Acari. With the *Trombidiidae* there are some superficial points of similarity, viz: the two pair of eyes and a segmented abdomen; but these have no importance at all. A twisted intestine with few coeca, an ovipositor and strongly dentated maxillae are also found in the *Oribatidae* but so differently shaped that they do not invite to further discussion. Between the *Gamasidae* and *Eucaridae* there are remarkable points of similarity. They have both of them a distinct movable pseudocapitulum with maxillary lobes (Winkler's „*Lobi externi der Maxillen*“ 20 p. 325) and a basal labial appendage (only one in the *Gamasidae*). The genital opening is in both found between the movable coxae. In spite of these interesting points of similarity there are so great differences between them in many respects that their relationship cannot be regarded as proved. The „*rostrum*“ is represented by a short bridge over the root of the antennae in the *Eucaridae* but is very long in the *Gamasidae*, the former have eyes, the latter have none; the *Notostigmata* have four pair of dorsal abdominal stigmata, the *Gamasidae (Mesostigmata)* one lateral pair continued into a long péritrème. On the first question „Is there any relation between the Eucaridae and any suborder of Acari“, we have got no definite answer; the investigation if there is any relationship between them and any order of Arachnids has yet to be made.

Drs. Hansen and Sørensen who in a paper under publication are enlarging our knowledge about the *Cryptostemma*, have communicated to me that there are points of similarity between the

Eucaridae and the *Pedipalpi* but especially the *Cryptostemma.* The labrum which is divided into a pars basalis and distalis is coalesced with the fused maxillae both in *Eucarus* and in *Cryptostemma.* The trochanter III and IV are in both the forms divided into two parts. These points of similarity are certainly very interesting, but when we take the great differences into consideration (comp. Hansen and Sørensen's paper) any nearer relationship between *Cryptostemma* and *Eucarus* is at least not evident. Thus the *Eucarus* is similar to *Gamasidae* as well as to *Cryptostemma* in some respects; in other respects f. inst. with regard to the odd position and great number of the stigmata they differ from both. The question then arises in what order it is most practically placed. The characters which are common to the *Cryptostemma (Pedipalpi)* and *Eucarus* are few and partly found in the *Gamasidae*; compare C. Börner (4), who has tried to prove that the mouth organs in the *Pedipalpi* and the *Gamasidae* are shaped in a corresponding manner. On account of that, and because it has the complete want of sternites in common with most Acari, and last but not least because the definition of this order is so very indistinct, I have called the *Notostigmata* a suborder of *Acari.* If *Eucarus* really is an Acarid, it is at least in possession of more arachnological characters than any other e. g. a great number of lyriform fissures, eleven abdominal tergites with longitudinal muscles, the well articulated legs etc. A. Michael wrote (12 p. 33 1894) „if a puzzling intermediate form occurs in the Acarine borderland, it is sure to be on the *Phalangium* border". The maxillae of the *Phalangium* is not fused. This fact seems to me so important that in spite of the divided labrum of *Phalangium* we are obliged to admit that *Eucarus* standing in the most extreme borderland, bears more similarity to *Cryptostemma* and consequently negatives the prophecy of the famous English author.

Other species and perhaps more distant relatives of the *Notostigmata* are certainly to be found in the exotic countries, when their abundance of small Arthropods has been explored. When once we have got a richer material, it will be possible to deal with the bearing of the characters of the genus and the family. The following definition of the suborder and family is only a provisional, perhaps an incorrect one. With regard to the specific characters I refer to the systematic part.

12. Systematic Part.

Notostigmata subord. nov.

(νῶτος back, στιγμή stigma.)

The skeleton is comparatively soft without sclerites, and there is a large segmented abdomen. Distinct movable pseudocapitulum. The labrum, falling into a pars basalis and a pars distalis, is coalesced with the fused maxillae and bears a pair of well developed maxillary lobes. Two labial appendages are present. The trochanters III and IV are divided into two parts. Many lyriform fissures. Four dorsal abdominal stigmata. The intestine communicates with the vent.

Eucaridae fam. nov.

Two pairs of eyes. The abdomen bears 10 (11) tergites. The short „rostrum" covers only the base of the three-jointed chelate antennae. The palps are pedate and the maxillary lobes are comb-shaped. The genital opening is placed between the third pair of coxae, and there is a short erectile ovipositor.

Eucarus n. g.

(ευ well, χαρής cuttable)

(comp. Michael 12 pag. 20.)

Opilioacarus C. With 21.

I prefer to change this badly chosen name with Eucarus, made in similarity with Acarus (ἀ-χαρής uncuttable) as it can scarcely be preserved in its present state.

1. The free part of the labrum is only as long as one fifth of the pseudocapitulum. Fifth tooth of the maxillary lobe bears no basal one. Labial appendages are only provided with two terminal hairs. The inner front margin of the trochanter II has above a row of four hairs.
   2. Abdomen almost as broad behind as in front. Patella of the second pair of legs with a dorsal median row of pointed hairs. Abdomen is reddish blue without any sharp distinction between coloured tergites and pale interarticulate membranes. *segmentatus.*
   2. Abdomen pointed and much more narrow behind than in front. Patella of the second pair of legs with a dorsal median row of pointed hairs and a single terminal clumsy hair. There is a sharp distinction between the blue abdominal tergites and pale interarticulate membranes. *Italicus.*
1. The free part of the labrum as long as one third of the pseudocapitulum. Fifth tooth of the maxillary lobe bears a basal tooth. Labial appendages with three median hairs besides the terminal ones. The inner front margin of coxa II has above a row of only three hairs. *Arabicus.*

Eucarus segmentatus C. With.

(Pl. IV—VI.)

Opilioacarus segmentatus C. With (21).

Body. The dorsal part of the cephalothorax merges gradually into the abdomen, the most elevated part of which is placed near its front margin, sloping smoothly towards the sides and the anal hill. The body is broadest near the front margin of the abdomen; but the hindmost part is only a little narrower. The first tergites are marked by distinct grooves and indistinct muscular spots, the last tergites only by distinct spots which are placed much nearer to each other than those of the first tergites. There are two oblong

eyes on each side. The three median external hairs of the *labial appendages* are missing (pl. IV fig. 19 a).

Pseudocapitulum. The free part of the *labrum* is only one fifth of the pseudocapitulum in length. Hindmost tooth of the maxillary lobe bears no basal tooth (comp. pag. 147 and pl. IV fig. 7). The *antennae* and *palps* comp. pag. 148, and pl. IV fig. 9 & 10. The distal part of the tarsus of the palps is provided with a great number of comparatively short dorsal hairs only curved forwards and downwards at their tip.

Legs. The first pair of legs are a little longer than the body, the fourth pair just as long or longer, and the second and third pair are shorter than the body.

Leg 1 compare pag. 153 (pl. V fig. 1 & 2).

Leg 2 (pl. V fig. 3). The inner side of the *trochanter* bears many fan hairs and few pointed hairs as well in the middle as below; at the outer side these two sorts of hairs are only found below. Along the interior front margin there is a row of four well articulated hairs, which are flat, broad and suddenly pointed; they decrease gradually downwards, so that the fourth of them is the shortest (pl. IV fig. 20). The dorsal side of the *femurs* bears an inner row of distal fan hairs and proximal pointed hairs and an outer row of fan hairs and pointed ones. The sides are provided with fan hairs and pointed ones. The *patella* is provided with a median dorsal row of pointed hairs and an inner and outer marginal one of fan hairs. Along each side there is a row of fan hairs. Below there are fan hairs and pointed ones. The *tibia* (*d*) is very similar to the patella (comp. pag. 155). The *metatarsus* is provided with proximal dorsal sense hairs (*s*) and several distal pointed ones. The marginal rows consist of fan hairs and sometimes of some distal pointed hairs. The hairs of the sides are almost arranged as in the patella. All the hairs of the *tarsi* with the exception of a cloven one behind the terminal straight one are pointed and thin. At the base of the claw-joint there is on each side an unilaterally plumiform hair (fig. 6 *p*). The claw-joint itself is described pag. 156 (pl. V fig. 6).

Leg 3 (pl. V fig. 4). The third pair of legs is a little shorter than the second pair, chiefly the femur. The *trochanters* are provided with fan hairs below and along the sides. Trochanter I is provided with a pointed hair on each side at the base of the trochanter II, the latter is provided with one or two fan hairs above. The sides of the *femurs* are provided with comparatively few fan hairs. Above there are fan hairs and a few pointed hairs. The *patella*, *tibia* and *metatarsus* are similar to those of the second pair of legs with the exception of the longer fan hairs of the metatarsus. There is no cloven hair near the tip of the tarsus.

Leg 4 (pl. V fig. 5 & 6). The sides of the two *trochanters* are below provided with a great number of fan hairs. Near the basis of the trochanter II there is a pointed hair. The trochanter II is provided with some few dorsal fan hairs. The inner side of the *femur* is provided with fan hairs all over, arranged in seven rows; the outer side has only fan hairs above and below, while there is a distal upper row of pointed hairs and behind these a few sense hairs (*s*). The *patella* has a median dorsal row of pointed hairs and marginal ones of fan hairs. The sides bear many fan hairs. The *tibia* (*d*) bears the usual dorsal, median row and a marginal inner and outer row of fan hairs, while the sides have inwardly two rows of fan hairs and outwardly an upper row of fan hairs and a lower one of pointed hairs and fan hairs. The *metatarsus* is provided above with proximal sense hairs (*s*) and several distal pointed hairs, and on each side of these it bears few but very long fan hairs. The sides have a single inner and outer row of fan hairs; below there are pointed hairs.

Sexual organs. The distance between the median paired glands of the male and the anus is five times as long as their diameter. The organs are described pag. 168 (pl. VI fig. 18).

Colour (pl. IV fig. 2). The head and first thoracical tergite is yellowish with lilac spots as described below. The most conspicuous spot is a more or less triangular one, broad at the back and placed in the middle of the head. On both sides of this spot the ocular ones are placed, including the eyes, encircled by black pigment. The lateral margin is covered by a broad spot; the front margin by another and narrower, prolonged backwards between the central spot and the ocular one by an outwardly bent pointed spot. Just in front of the central spot there is a distinct pale one encircled by lilac. The first thoracic segment is mounted by a *dorsal median transverse spot* (pl. IV fig. 2 *t*), consisting of a rigth and a left part, connected with a median part half as broad as the lateral, and bent backwards. The second thoracic tergite and first abdominal ones are lilac and separated from each other by comparatively broad yellowish stripes. The remaining dorsal part of the abdomen is lilac but darker behind with the exception of the indistinct yellowish stripe between the tergites and the distinct yellowish muscular spots. The sides and ventral side of the body are yellowish. The palps are more or less lilac. The first pair of legs is reddish blue with the exception of some few yellow spots. The three last pairs are more ore less coloured with the exception of the terminal parts of the distal joints, which are blue, chiefly in the fourth pair of legs.

Measurement. The largest females measured 2,75 in length and 1^{mm} in breadth, the smallest males 2,2 and $0,75^{mm}$. The length of the pseudocapitulum is $0,45^{mm}$, the length of the free part of the labrum $0,08^{mm}$, of the antennae 0,45, and of the palps 0,70. Leg 1 is between 3,18—3,43. Leg 2 1,80—2,00. Leg 3 1,60—1,98. Leg 4 3,60—3,29.

Material and Locality. I have examined about 30 specimens, males and females, from Algeria Maima. Only four females had the ovipositor invaginated.

Variation. Two specimens (♂) from Bon Saada (Algeria) were a little different from the described species, but not in such a degree that I found it necessary to put them down as a new species. Only the first tergites of the abdomen are distinct. There is only one pointed hair between the sense hairs and the tip of the metatarsus in the fourth pair of legs. The distance between the median paired glands of the male and the anus is only two or three times as long as their diameter.

The median spot of the head is more or less wiped out in front. The *transverse spot* of the first thoracic segment is very narrow in the middle, a mere coloured line. The colour of the abdomen is more effaced, the yellow parts of the three last pairs of legs are more marked.

Eucarus Italicus n. sp.

Body. The body is almost flat above and broadest near the front margin of the abdomen which gradually gets narrower at the back, so that the tip is a little pointed and only one sixth as broad as the front part. The tergites are marked by indistinct muscular spots, but chiefly by being coloured, and separated by pale inter-articulation membranes. The front margin of the head is provided with a blunt, short tooth on each side.

The *labial appendages*, the *pseudocapitulum* and the *antennae* seem to be very much like those of *Eu. segmentatus.* The distal part of the tarsus of the *palps* has no pointed hairs that are curved only at the tip.

Legs. Not only the first and fourth pair of legs are longer than the body but also the second and third ones. The legs are comparatively thicker than those of *Eu. segmentatus.* The pointed hairs are often more clumsy.

Leg 1 is scarcely different from that of the other species.

Leg 2. Both the outer and inner side of the *trochanter* are provided with fan hairs in the middle and below. There are four pointed hairs along the front margin as in *Eu. segmentatus.* The terminal hair of the median dorsal row of pointed hairs is short and thick in the *patella.* The inner marginal row consists of fan hairs, while the outer marginal one consists of two well developed fan hairs and several thick and clumsy pointed hairs. The inner side bears an upper row of fan hairs and a lower one of pointed hairs; the outer one only two rows of fan hairs. The *tibia* is very

similar to the patella. The inner side bears an upper row of pointed hairs and a lower one of fan hairs. The *metatarsus* and *tarsus* are scarcely different from the correspondent joints of *Eu. segmentatus.* The cloven dorsal hair near the base of the claw joint is missing.

Leg 3. The *femurs* have many fan hairs along the inner side and along the outer side many pointed hairs. The *patella* is provided with the usual dorsal row of pointed hairs, of which the distal ones are very clumsy. The inner marginal row consists of clumsy pointed hairs and fan hairs, the outer marginal row of well developed fan hairs. The sides bear two rows of fan hairs and pointed hairs. The *tibia* is very similar to the patella. Below there are long pointed hairs. The arrangement of the hairs of the *metatarsus* is the same as in *Eu. segmentatus.* The terminal pointed hairs below and especially above are thick and rather compressed.

Leg 4. The *trochanter* and the *femur* are like those of *Eu. segmentatus.* The *patella* bears the usual dorsal median row of pointed but clumsy hairs, an inner marginal row of clumsy pointed hairs and a terminal fan hair and an outer marginal one of fan hairs. The sides are provided with many fan hairs. The *tibia* bears at the upper side the usual median row and an inner and outer row of fan hairs. The sides have inwardly an upper row of pointed hairs and a lower one of pointed and fan hairs, and outwardly an upper row of fan hairs and a lower one of pointed hairs. There are many fan hairs below. The hairs of the upper side of the *metatarsus* are like those of *Eu. segmentatus.* The sides are provided with an upper row of pointed hairs and a lower one of fan hairs. The *tarsus* is provided with two thin pointed hairs below near the groove between the two pieces of the tarsus. The distal part of these hairs is directed backwards and forms an obtuse angle with the proximal part.

Colour. The predominating colours are yellow and blue. The cephalothorax is provided with the following blue spots: The most conspicuous is the median triangular spot with a large ocular one on each side, while there is no spot along the front margin. The margins of the coxal projections are stained with blue, and further to the upper side there are four lateral blue spots placed more or less near to each other. The *transverse spot* of the first thoracic segment seems to be dissolved into two transverse spots directed forwards and outwards and a short straight median one between the two transverse ones and almost in connection with them. The second thoracic tergite is decorated with a short narrow transverse band, slightly bent backwards, and the first abdominal tergite with one which is bent slightly backwards in the middle and near the lateral margin directed backwards and outwards under an obtuse angle. The transverse bands of the three next tergites are very narrow and do not reach the margin. The following bands gradually become broader and shorter backwards, so that the penultimate, the broadest, is three to four times as broad as the first. The lateral parts of the fifth and sixth bands are directed backwards. Each half part of the anal hill has a blue spot. The interarticulation membranes between the tergites are pale. The ventral side is yellowish with the exception of an indistinct longitudinal blue sternal spot. The appendages are almost coloured as in *Eu. segmentatus*.

Measurement. The single speeimen measured in length 1,25^{mm} and in breadth 0,50^{mm}. The length of the antenna is 0,32^{mm}, and of the palps 0,52. Leg 2 measured 1,49, leg 3 1,40 and leg 4 2,12^{mm}.

Locality. I have only examined one not full-grown specimen, which Dr. C. Börner has caught under a stone at the foot of the Monte Pelegrino near Palermo in the month of March.

Eucarus Arabicus n. sp.

(Pl. IV fig. 14, 18 and 21; pl. VI fig. 19.)

Body. The back of the head and of the abdomen do not merge gradually into each other, as the first abdominal tergites are almost perpendicular, else the shape of the body is as in *Eucarus segmentatus*.

All the segments are marked by grooves, while the muscular spots, of which those in the median rows are placed near to each other just as the hindmost ones in *Eu. segmentatus*, are comparatively indistinct. The head is more hairy, and the hairs, chiefly those in front, much longer. The first pair of eyes are round, the second oblong. The *labial appendages* bear three median slender hairs that are directed outwards.

Pseudocapitulum. As I had only one specimen at my disposal, I have not been able to examine and understand the pseudocapitulum in the details, which I regret, because there seems to be some important structural differences, perhaps of generic value. The free part of the labrum is very well developed, directed upwards, toothed, and as long as one third of the pseudocapitulum. The hindmost largest fifth tooth of the maxillary lobe bears a secondary basal tooth. I have not seen any *maxillary plate*, so that it must either be missing or shaped quite differently. There is a well developed *maxillary spine*. The *lateral lobes* on each side of the mouth of *Eu. segmentatus* are comparatively small (only 1/20 of the length of the pseudocapitulum) but in this species they are large and very conspicuous. (1/10 as long as the pseudocapitulum). Their lateral parts seem to be directed upwards to coalesce with the labrum, in this way forming a very spacious mouth: their median parts are divided by an incision inwardly into two rounded lobes provided with small teeth and have outwardly a long process, the pointed tip of which is directed inwards. This structure of the lateral lobes perhaps corresponds with the great development of the free part of the labrum.

Antennae. The antennae are scarcely different from those of *Eu. segmentatus*.

Legs. The *palps*, the first, and the fourth pair of legs are missing. The second and the third pair of legs are slender and much longer than the body. There is no sharp distinction between the fan hairs and the pointed hairs, as set forth pag. 143; the pointed hairs of the distal joints are more similar to those of *Eu. segmentatus*.

Leg 2. The dorsal tooth of the *trochanter* is placed comparatively far from the front margin. The sides of the trochanter, chiefly the inner ones, are provided with many pointed and toothed hairs (pl. IV fig. 18) but with only few fan hairs below and in front. There are only three pointed hairs in the perpendicular row along the interior front margin; the third one is the shortest and much more distant from the second than the latter is from the first (pl. IV fig. 21). The *femurs* are provided with a median dorsal row of pointed hairs and an inner and outer marginal one of fan hairs and pointed hairs; along the sides there is a row of fan hairs, going from the upper distal corner to the lower proximal one, which are bent downwards, and besides these there are some pointed hairs placed distally and above. Along the back of the *patella* there is a row of pointed hairs; besides those it bears a proximal and terminal fan hair or clumsy pointed hair, and along the inner and outer margins there are rows of fan hairs and pointed hairs. The sides bear a row of fan hairs and pointed hairs at the inner side, while at the outer one there are only pointed hairs. The hairs of the *tibia* and *metatarsus* are arranged as in the patella with the exception of the usual dorsal rows. Below there are only pointed hairs, and the lateral hairs of the metatarsus are more regularly placed. Besides the usual pointed hairs the *tarsus* bears a well developed fan hair on each side. The straight terminal hair is short and thin, and there seems to be a cloven hair. There are no plumiform hairs at the base of the claw joint, but there are some hairs which are thicker at the tips. The end of the claw joint forms a stalked „areolum".

Leg 3. The *trochanter I* bears many „toothed" hairs and a single fan hair on the inner side, but many fan hairs on the outer side, while the *trochanter II* has both fan hairs and toothed hairs both inwardly and outwardly. The *femurs* are provided with dorsal marginal rows of fan hairs and pointed hairs and with three lateral rows on each side, the upper one of which consists of fan hairs and pointed hairs, the lower one only of pointed hairs. The median

dorsal row of the *patella* consists of clumsy pointed hairs, the inner marginal row of clumsy pointed hairs and the outer one of fan hairs. Along the sides there are rows of clumsy pointed hair. The *tibia* bears an inner dorsal marginal row of pointed hairs and an outer row of fan hairs and pointed hairs. Along the sides there are pointed and fan hairs, below at the inner side both fan hairs and pointed ones, but at the outer side only pointed ones. The arrangement of hairs in the *metatarsus* is like that of the tibia with the exception of the inner marginal row of pointed and fan hairs and the outer marginal row of fan hairs as well as of the usual median dorsal row. The *tarsus* bears two inner proximal fan hairs and a single outer one, but the cloven hair is missing. The claw joint is like that of the second pair of legs.

Inner anatomy. As far as I have been able to see through the skin, the inner anatomy does not seem to be quite similar to that of *Eu. segmentatus.* The *intestine* is — at least behind — twisted to the left towards the vent; it is filled with the same round bodies. Especially the structure of the *accessory glands* of the male differs very much, as seen in pl. VI fig. 19. In front of the indistinct genital opening the two usual „*copulatory suckers*" (*s*) are seen and a transverse „*vestibulum*" (*v*). This is continued into a large sac (*g*) *the median unpaired gland* which is very much enlarged behind and laterally. Seen from below the sides of this median sac are covered in front by a large sac on each side (*h*), *the paired median gland* and are placed themselves above a pair of rather short sacs (*f*), *paired lateral glands*; the *posterior paired median* glands seem to be missing, if not corresponding to the lateral hindmost part of the median sac (*i*); it will thus be seen that there are so great differences between the systems of the two species, that even the comparison seems doubtful.

Colour. The colour is most like that of *Eu. segmentatus.* The median triangular spot of the head is well developed and reaches to the front margin of the head; on account of that the front marginal spot has been divided into a right and a left irregular spot partly placed between the eyes and the median spot. The ocular spot merges into the large lateral one. The *transverse spot* of the first thoracical segment is bent slightly backwards, and there is no marked difference between the median and the lateral parts these ones being only a little broader, directed forwards and gradually merging into the former. The other tergites are blue with indistinct yellowish interarticulation membranes.

Measurement. The single specimen measured in length $1{,}80^{mm}$, and in breadth $0{,}50^{mm}$. The length of the labial appendages is 0,22, of the pseudocapitulum 0,46, of the free part of the labrum 0,16 and of the antenna 0,45. Leg 2 measured 2,60, and leg 3 $2{,}40^{mm}$.

Locality. I have only examined one mutilated male from Aden — Arabia felix.

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Explanation of the Plates.

Plate IV.

A * by a cipher in Plate IV and V states that the corresponding figure is drawn by Dr. H. J. Hansen.

Figure

1.* Eucarus segmentatus. ♀ vix × 16.
1. Groove between the head and thorax, 2. between the thorax and abdomen. *a.* anal hill.

2.* E. s. ♂ × 24 showing the colour. *s.* stigmata; *m.* muscular spots.

3.* E. s. ♂ × 32 seen from below, showing the coxae; *m.* maxillary lobe; *a.* labial appendages; *b.* copulatory sucker.

4.* E. s. ♂ × 95. Pseudocapitulum seen from the side, covered by the front margin. *r.* „rostrum" placed above the base of the antennae and coalesced with the backwardly directed projection of the maxillae divided into two teeth *b*; 1. root of the antennae; *l.* labrum; *m.* maxillary lobe; *p.* maxillary plate; *t.* trochanter of the palps.

5.* E. s. ♂ × 70. Pseudocapitulum seen from above showing the „rostrum" *r*; the first and third joint of the antennae 1 and 3; *m* and *l* as in 4.

6.* E. s. × 106. Foremost part of the pseudocapitulum as it is seen when the antennae are taken away. *l.* pars distalis of the labrum.

7.* E. s. × 260. Left maxillary lobe and plate seen from the inner side. 1, 2 and 3 thickened lists; *f.* front margin curled outwardly; *s.* maxillary spine; *m.* as i 4.

8. E. s. × 210. Labrum *l.* and *i.* left lateral lobe, seen from the inner side with the two rows of teeth.

9. E. s. × 60. Palp. *f.* femur; *t.* proximal part of the tarsus.

10. E. s. × 148. Left antenna seen from the inner side. *c.* tendon of the adductor; *d.* abductor.

11. E. s. × 160. Fan hairs from the femur.

12. E. s. × 140. Fan- and sense hairs from the metatarsus.

13. E. s. × 150. Terminal hair of the tibia with fan- and pointed hairs.

14. Eu. Arabicus × 160. Clumsy pointed hairs from the patella.

15. E. s. × 160. Usual pointed hairs of metatarsus.

16. E. s. × 175. Hairs of the head.

17. E. s. × 350. Lyriform area, showing the chitinous bar, surrounding the membraneous area with a median spot.

Figure

18. Eu. Arabicus $\times$ 150. Dentáted and fan hairs from the trochanter II (leg 2).
19. E. s. $\times$ 60. The sternum seen from below. 1. coxa I; *a.* labial appendage; *g.* granular part of the salivary duct *t*; *c.* prolongations of the coxae over the basal enlarged part of the tube; *f.* lyriform fissures.
20. E. s. $\times$ 145. coxa II seen from the inner side.
21. Eu. Arabicus $\times$ 145. coxa II seen from the inner side.

Figure

Plate V.

1. Eucarus segmentatus ♀ $\times$ 54. Left leg 1 seen from behind. *a.* trochanter; b^1. basal part of the femur; b^2. distal part; *c.* patella; d^1. and d^2. first and second part of the tibia; *e.* metatarsus; *f.* tarsus.
2. E. s. $\times$ 215. The distal part of the tarsus I. *t.* terminal hair.
3. E. s. ♀ $\times$ 55. Right leg 2 seen from before. *a*, b^1 and *d.* as in figure 1; f^1. basal part of the tarsus; f^2. distal part; *s.* sense hairs.
4. E. s. $\times$ 49. Right leg 3, seen from behind. The signature as in 3.
5. E. s. ♂ $\times$ 47. Right leg 4, seen from behind. *a—f* as in 1 and 2. *s.* sense hairs.

6.* E. s. $\times$ 210. Distal part of tarsus IV. *t.* terminal hair; *p.* plumiform hair; *u.* upper hair; *l.* lower hair.

7.* E. s. $\times$ 110. Ovipositor dissected out and seen from the outer side. *s.* three-divided projection; *m.* sheath in which the ovipositor is invaginated.

8.* E. s. ♀ $\times$ 50. Ovipositor seen from behind. *c.* copulatory sucker.

9.* E. s. ♀ $\times$ 50. Ovipositor seen from before.

10.* E. s. ♀ $\times$ 200. Copulatory sucker with the different forms of hairs.

11. E. s. ♀ $\times$ 25. The indrawn ovipositor with the oviducts *o.* *g.* spacious gland; *i.* intractors of the ovipositor, *c.* copulatory suckers with its muscles *mc.*
12. E. s. $\times$ 150. Muscular sack of the intestine.
13. E. s. $\times$ 35. The skin of the right side seen from the outside — partly combined — showing the arrangement of the skin muscles and tracheae. *s.* the stigmata; g^1. groove, separating the head from the thorax; g^3. between thorax and abdomen; *lf.* lyriform fissure; *la.* „lyriform" area; *c.* copulatory sucker with muscles *mc.* *gf.* front genital plate; *gh.* hindmost genital plate; l^1, l^2, l^3, l^4 the interior, exterior, lateral and ventral longitudinal bands; *mg.* and *mf.* muscles in front of the genital opening; t^1—t^8. transverse muscular bands, sometimes (the median) consisting of the following muscles m^1. and m^2. below, m^3. directed forwards and upwards to meet the preceding band, m^4. and m^5. directed backwards and upwards in continuation of each other; m^6. directed forwards and uppwards to meet the upper part of the preceding band; m^7. directed backwards to connect the upper tips of the two bands; c^1, c^2, c^3 and c^4. muscles connecting the transverse bands with the lateral longitudinal one (l^3); *f.* muscle directed forwards and downwards; *sp.* muscular spots, placed where a muscular fibre is fastened.

Figure

Plate VI.

1. E. s. ♂ $\times$ 40. Sagittal almost median section through the pseudocapitulum and front part of the head. *r.* rostrum; *an.* antenna; *l.* labrum; *ct.* constrictores and *di.* dilatores of the pharynx; *la.* labial appendage; *n.* brain; *a.* antennar gland.
2. E. s. ♂ $\times$ 22. Sagittal more lateral section showing the oesophagus *o*; *co.* colon is well separated from *j.* the small intestine, having no communication with *ve.* the ventricle; *z.* glandular cells; *b.* maxillary gland; *e.* excretory tube; *n.* brain; *t.* testis; *pe.* two-branched sack; *g.* median unpaired gland; *i.* posterior median paired glands; *m.* clear dorsal organ.
3. E. s. ♂ $\times$ 22. Still more lateral sagittal section showing the communication between the ventricle and small intestine. *z.* glandular cells in the front coeca; *re.* rectum; *d.* coxal glands; *f.* paired lateral glands; *h.* front median paired glands; *g*, *i*, *t* as in fig. 2.
4. E. s. ♂ $\times$ 22. Sagittal very lateral section showing the different accessory glands well separated from each other. *e*, *f*, *g*, *h*, *i* and *t* as in fig. 2 and 3.
5. E. s. $\times$ 130. Transverse section trough the distal part of the pharyngeal tube, showing the keeled labrum, the tricarinate pharynx, *p*, with its dilator muscle, *di*; *l.* labrum; *tu.* salivary duct.
6. E. s. $\times$ 135. Transverse more proximal section near the rostrum and showing the upwards maxillary projections, almost surrounding the antennae. *p.* pharynx; *di.* dilator; *ct.* constrictor pharyngis the fastening of which is not seen; *tu.* salivary duct; *l.* labrum.
7. E. s. ♂ $\times$ 50. Transverse more anterior section through the median part of the cephalothorax. *a.* antennar glands; *b.* maxillary glands; *c.* horse-shoe glands; *d.* coxal glands; *en.* endosternite; *o.* oesophagus; *n.* brain.
8. E. s. ♂ $\times$ 50. More median transverse section. *c.* and *en.* as in 8. *pe.* twobranched sack of the male; *v.* vestibulum. *s.* copulatory sucker.
9. E. s. ♂ $\times$ 43. Transverse section through the front part of the accessory glands. *g*, *h* and *f* as in 18.
10. E. s. ♂ $\times$ 44. Front abdominal transverse section through the hindmost part of the accessory glands. *m.* clear dorsal sack; *t.* testis; *e.* excretory organ; *f* and *i* as in 18.
11. E. s. ♀ $\times$ 43. Transverse section through the front part of the abdomen. *ve.* ventricle; *od.* oviduct; *ov.* eggs; *z.* glandular cells. In the middle are drawn some pollen granules. The tunica propria to the left has loosened from the intestine the epithelium of which is sometimes low, sometimes more raised.
12. E. s. ♀ $\times$ 43. Transverse section through the hindmost part of the abdomen. *j.* the small intestine and *co.* colon are yet separated by *ve* hindmost part of the ventricle; *e.* excretory tube; *ov.* eggs; *z.* glandular cells.

Figure
13. E. s. ♀ × 43. Transverse section through the abdomen. The colon and small intestine are fused but yet easily discerned from each other. *q.* small thickwalled tubes. *co*, *j*, *e*, *ov*, *z* as in fig. 12.
14. E. s. × 35. Horse-shoe gland with coxa I.
15. E. s. × 175. Coxal gland.
16. E. s. ♂ × 50. Two-branched male organ.
17. E. s. ♂ × 40. Testis and excretory tube. *u.* secreted bodies. *t.* and *e.* as in fig. 2.
18. E. s. × 30. Male accessory glands. Seen through the skin and half skeleton-like. *c.* copulatory sucker; *v.* vestibulum; *f.* paired lateral glands; *g.* median unpaired; *h.* anterior median glands; *i.* posterior median gland.
19. Eucarus Arabicus × 73. Signature as in fig. 18.

23.—9.—1903.

Om jordfundne Pattedyr fra Danmark.

Af

Herluf Winge.

Med Tavle VII—XIII.

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