

ACARI OF THE GENUS *DINO*GAMASUS FROM *KOPTORTOSOMA* PUBESCENS AND *K. AESTUANS* (HYMENOPTERA)

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As is well known, the females of various species of at least some of the described subgenera of carpenter-bees (*Xylocopa* Latreille) have a so-called acarus chamber, or acarus pouch in their abdomen. This pouch is attached to the inside of the vertical wall of the second abdominal (first gastral) segment, the entrance opening being situated at the front side of the same segment. The pouch is usually entirely filled up with a cluster of large mites of the genus *Dinogamasus* Kramer and, generally speaking, it can be held that every species of *Xylocopa* whose females have such a pouch accommodates its own species of mite.

The most important articles dealing with the systematics of these mites are those published by A. C. OUDEMANS, H. Graf VITZTHUM, and Miss NORMA LEVEQUE. Papers of a more general nature on the same subject have been published by PERKINS (1899), OUDEMANS (1.XI.1903, 8.XII.1903), VITZTHUM (1924), LEVEQUE (1932) and VAN EYNDHOVEN (1941), while VITZTHUM (1941: 548—550, 576) has given a comprehensive survey. In 1952 SKAIFE published a very interesting paper dealing with the development in *Koptortosoma* nests of both *Koptortosoma caffra* (L.) and *Dinogamasus braunsi* (Vitzthum). This detailed study answers many questions, as it seems probable that these life-cycles will be more or less the same for other species.

The present note only deals with mites found on carpenter-bees of the genus (or subgenus) *Koptortosoma* Gribodo. Dr. M. A. LIEFTINCK sent to me a number of female bees, identified by him as *Koptortosoma pubescens* (Spinola) and *K. aestuans* (L.). He requested me to examine the mites in the acari pouches and to compare my identifications of the mites with his identifications of the bees (cf. LIEFTINCK, 1964).

The genus *Dinogamasus* has been divided in four species-groups which, as a whole, are in correlation with those existing (systematically and/or geographically) for the bees. The *braunsi* group belongs to the *Koptortosoma* of the African continent, the *alfkeni* group is found with the *Koptortosoma* inhabiting central and southeastern Asia, the *perkinsi* group lives with bees of the subgenus *Platynopoda*, and the *octoconus* group is specialized on *Cyaneoderes*.

The most conspicuous character shared alike by all members of the *braunsi* group is the presence of a hook-like hair on both tibia and genu (patella) II (fig. 1—4). Up to now about 15 species showing this character have been described. No other *Dinogamasus* mites possess hairs modified in this particular way.

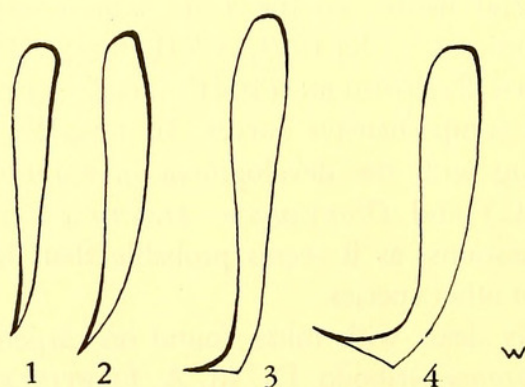
In the *octoconus* group all hairs of genu II have been transformed to cone-like spines, thus showing a group of eight blunt cones on this single joint. There are two species.

The *perkinsi* group shows as most important character an incision in the side margin of the dorsal shield. This group consists of four species.

Mites of the *alfkeni* group lack the above special characters and thus only have the normal, general aspect. About 11 species belong to this group.

According to LEVEQUE (14.X.1930) we should find in the Egyptian *Koptortosoma pubescens* (called *aestuans* L. in her paper) the mite species *Dinogamasus inflatus* LeVeque. This proved to be correct, and LIEFTINCK's studies have shown that *D. pubescens* occurs as well on the mainland of the eastern Mediterranean as in Southeast Asia. All his material investigated by me contained a single species of mite, viz., *Dinogamasus inflatus*. This is in accordance with LEVEQUE (13.VI. 1930) who records for *Koptortosoma pubescens* (*K. aestuans* in her publication) and *D. inflatus*, two localities in northern India, viz., Chikar Kot, N.W. Province, and Jammu, Kashmir. As *D. inflatus* is a typical member of the African *braunsi* group, this strongly supports the view that *Koptortosoma pubescens* has originated on the African continent and has migrated toward the east, and that it is not an Asiatic species which has moved westward.

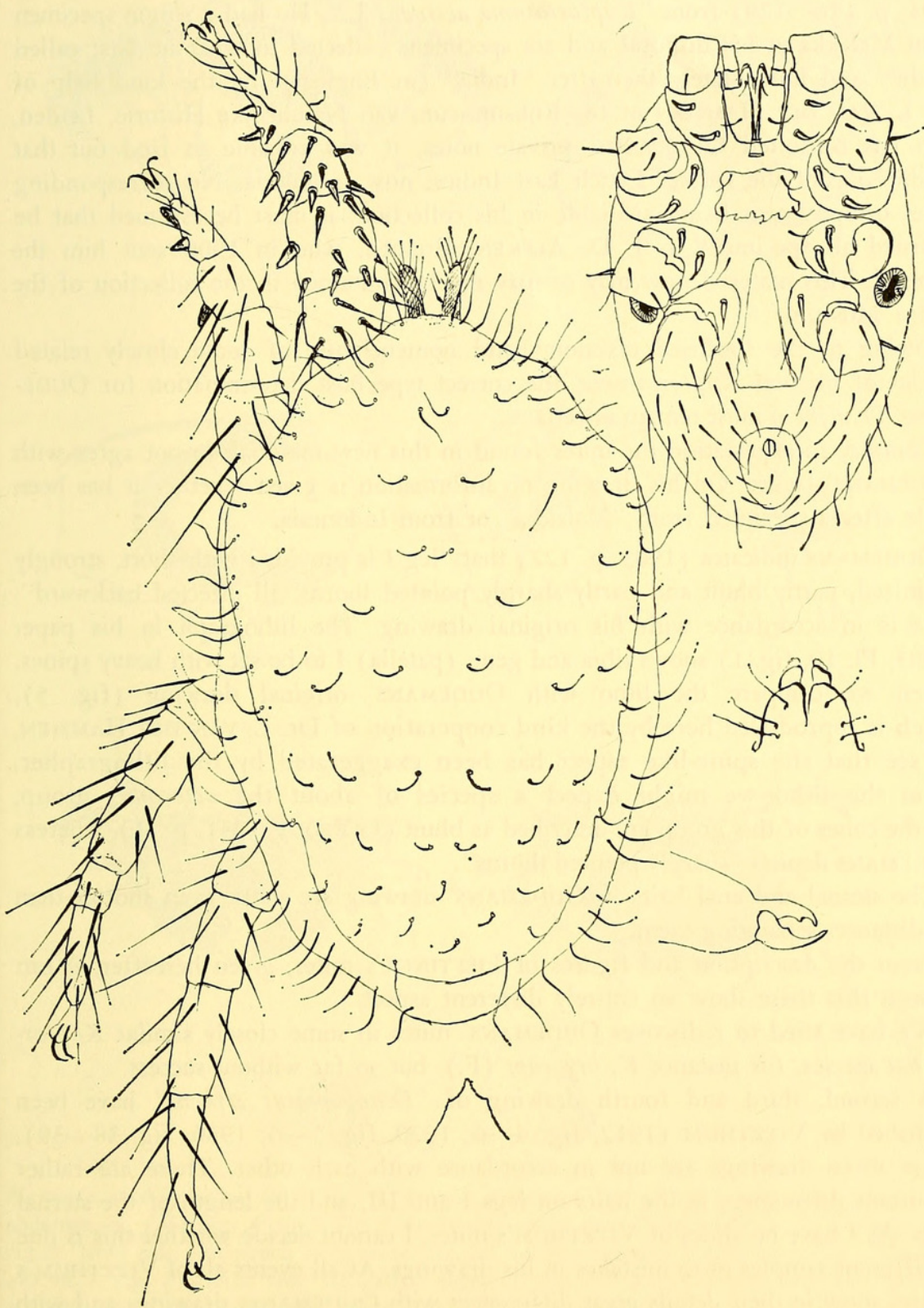
The material of *D. inflatus* shows that the hook-like hairs of tibia and genu (patella) II demonstrate a great variability running from a slightly curved apex to a complete hook (fig. 1—4).



Dinogamasus inflatus LeVeque. fig. 1—4, four types of hook-like hairs of tibia and genu II. (B. WEIJDE del.)

The investigated material of *Dinogamasus inflatus* LeVeque originates from 8 specimens of *Koptortosoma pubescens* (Spinola) labelled "Egypten", ex coll. C. & O. VOGT, now in the Zoölogisch Museum, Amsterdam. Two specimens of the same host in the collection of the Rijksmuseum van Natuurlijke Historie, Leiden, are labelled: S. India, Pondicherry State, Karikal, March and May, 1962, P. Susai Nathan. Slide preparations of the mites are deposited partly in the Amsterdam and partly in the Leiden museums.

As has been pointed out by LIEFTINCK, the bee identified by LEVEQUE as *Xylocopa confusa* J. Pérez from Java is the same species as *aestuans* (L.). It could be expected from LEVEQUE's studies that the material of that species now before me contained mites belonging to the *alfkeni* group. This proved to be right.



Dinogamasus alfkeni Oudms. fig. 5, original drawing by A. C. OUDEMANS

The correct species name for the *Dinogamasus* found in the present material of *K. aestuans* from Java offers some difficulties which can not entirely be solved at this moment. *Dinogamasus alfkeni* was first described by OUDEMANS (1902, p. 37, 1903, p. 126—128) from "*Koptortosoma aestuans* L.". He had a single specimen from Malakka at his disposal and six specimens collected in what he first called "Indië" and immediately thereafter "India" (in English). By the kind help of Dr. L. VAN DER HAMMEN of the Rijksmuseum van Natuurlijke Historie, Leiden, who has consulted OUDEMANS' private notes, it was possible to find out that "Indië" meant the former Dutch East Indies, now Indonesia. No corresponding slides or specimens being available in his collection, it must be assumed that he returned all specimens to J. D. ALFKEN, Bremen, who in 1900 sent him the material. This material now may or may not be contained in the collection of the Berlin Museum.

Owing to the confused taxonomy and nomenclature of some closely related species of oriental *Koptortosoma*, the correct type host determination for OUDEMANS' *D. alfkeni* must remain uncertain.

Contrary to expectation the mites found in this new material do not agree with OUDEMANS' figure. On his drawing no information is given whether it has been made after a specimen from "Malakka" or from Indonesia.

OUDEMANS indicates (1903, p. 127) that "leg I is provided with short, strongly chitinized, partly blunt and partly sharply pointed thorns, all directed backward". This is in accordance with his original drawing. The lithograph in his paper (1903, Pl. 10, fig. 1) shows tibia and genu (patella) I to be set with heavy spines. When we compare the litho with OUDEMANS' original drawing (fig. 5), which is reproduced here by the kind cooperation of Dr. L. VAN DER HAMMEN, we see that the spine-like aspect has been exaggerated by the lithographer. From the litho we might expect a species of about the *octoconus* group, but the cones of this group are described as blunt (LEVEQUE, 1931, p. 11), whereas OUDEMANS depicts "sharply pointed thorns".

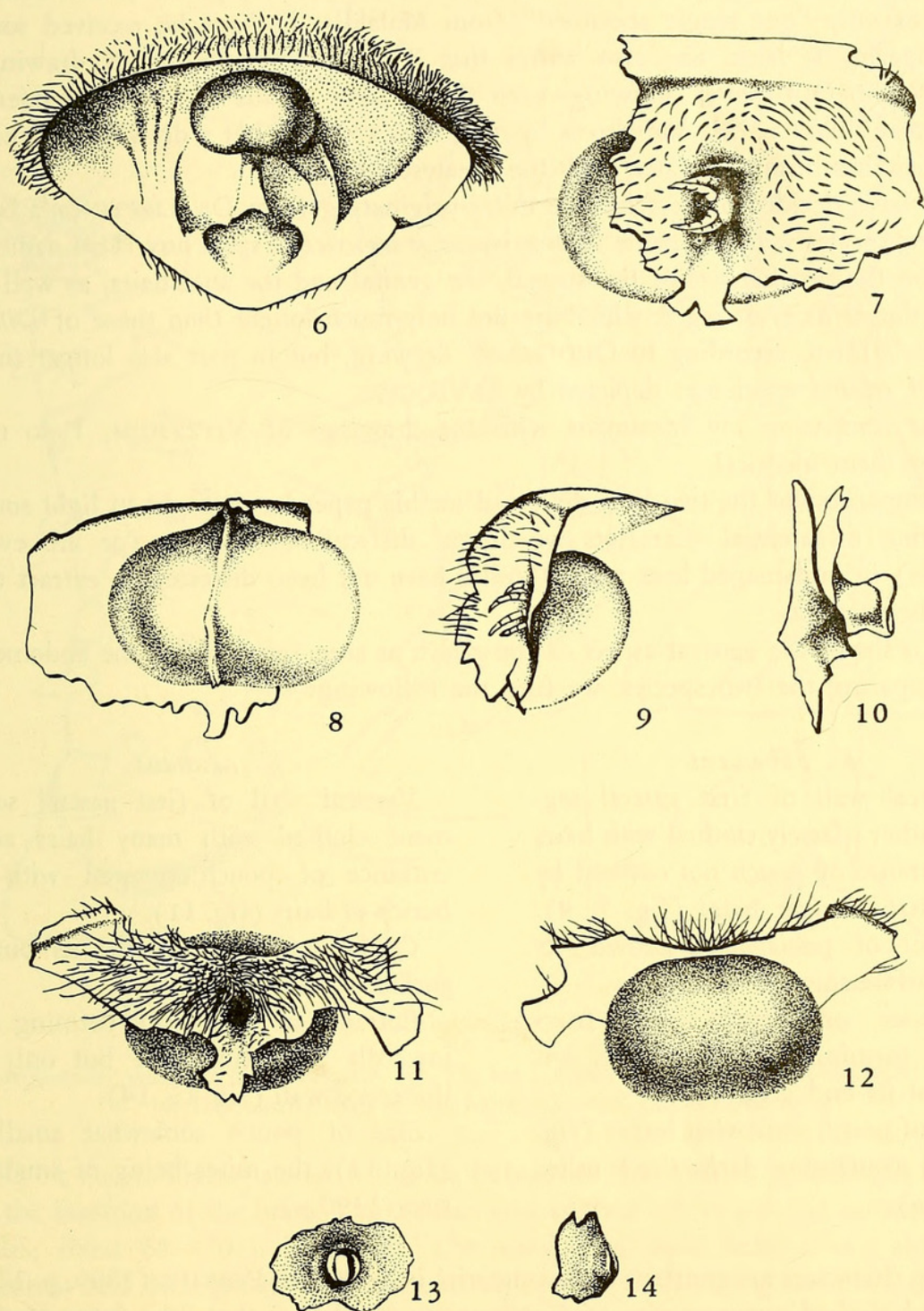
The sternal and anal hairs in OUDEMANS' drawing are short, even shorter than the distances separating them.

From the description and figures of LIEFTINCK's mites, given hereafter, it can be seen that these show an entirely different aspect.

We have tried to rediscover OUDEMANS' mites in some closely similar *Koptortosoma* species, for instance *K. bryorum* (F.), but so far without success.

A second, third and fourth drawing of "*Dinogamasus alfkeni*" have been published by VITZTHUM (1912, fig. 4—6; 1920, fig. 5—6; 1930, fig. 38—39). These three drawings are not in accordance with each other. There are rather important differences in the hairs on legs I and III, and the length of the sternal hairs. As I have no slides of VITZTHUM's mites, I cannot decide whether this is due to different samples or to mistakes in his drawings. At all events all of VITZTHUM's figures show in their details great differences with OUDEMANS' drawings and with LIEFTINCK's mites.

It would be easy to give a new name to the "*Dinogamasus alfkeni*" of VITZTHUM, but without having seen his slides and owing to the differences in his various drawings, I prefer not to introduce any new name at this moment.



Koptortosoma bryorum (F.). fig. 6, general aspect of the acarus pouch from within the abdomen. *K. pubescens* (Spin.). fig. 7, front side of 1st gastral segment; fig. 8, acarus pouch; fig. 9, front side and pouch from aside; fig. 10, tubular entrance inside the pouch. *K. aestuans* (L.). fig. 11, front side 1st gastral segment; fig. 12, acarus pouch; fig. 13, entrance with thickened wall inside the pouch; fig. 14, the same, from aside. Fig. 7—14 are in the same proportion. (B. WEIJDE del.)

LEVEQUE writes (1931, p. 3) that she has seen several of OUDEMANS' specimens originating from Singapore. But in his publication (1903, p. 126) OUDEMANS mentions only "one single specimen" from Malakka. Perhaps he received some more specimens later. She also writes that VITZTHUM made correct drawings. However, in OUDEMANS' drawings even the smallest details are usually rendered with great accuracy; this one also is by no means a sketch, but a drawing in which every hair has been delineated with the greatest care.

So I have decided to describe the mites originating from Dr. LIEFTINCK's bees as a new species with the name *Dinogamasus macrotrichus* spec. nov. This name is based on the peculiarities of the sternal, the genital and the anal hairs, as well as of the dorsal hairs of leg I, which are not only much longer than those of *Dinogamasus alfkeni*, according to OUDEMANS' drawing, but in part also longer than those of related species as depicted by LEVEQUE.

After comparing my specimens with the drawings of VITZTHUM, I do not consider them identical.

A comparison of the two bees discussed in this paper has brought to light some interesting differential characters which are difficult to observe (or are even invisible) in undamaged bees whose bodies have not been dissected to extract the mites they contain.

Fig. 6 shows the general aspect of the pouch as seen from within the abdomen. On comparing the two species, we find the following:

K. pubescens

Vertical wall of first gastral segment rather sparsely clothed with hairs and entrance of pouch not covered by a bunch of longer hairs (fig. 7, 9).

Colour of pouch pale brown, its outer surface smooth.

Entrance of pouch, seen from within, forming a distinct tube, widened at its end (fig. 10).

Size of pouch somewhat larger (fig. 8) and containing large-sized mites (1730 μ).

K. aestuans

Vertical wall of first gastral segment clothed with many hairs and entrance of pouch covered with a bunch of hairs (fig. 11).

Colour of pouch black, its outer surface somewhat coarse.

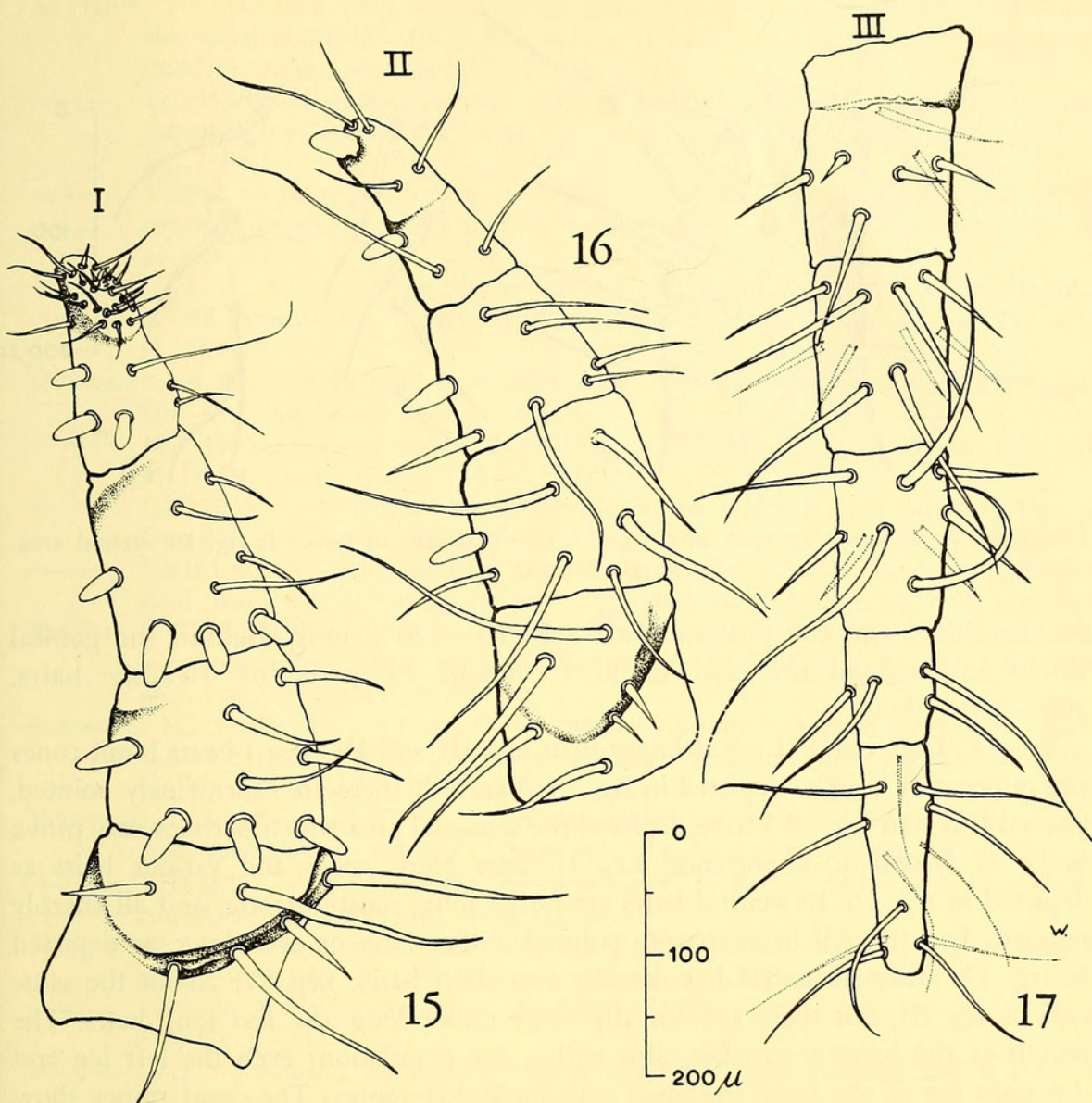
Entrance of pouch not forming an inwardly projecting tube but only a thickened wall (fig. 13, 14).

Size of pouch somewhat smaller (fig. 12), the mites being of smaller size (1390 μ).

These characters are constant in the material investigated. PERKINS (1899, p. 37), who had studied seven species of *Koptortosoma*, indicates that "the form of the chamber would appear to be constant for a particular species of bee".

Dinogamasus macrotrichus spec. nov.

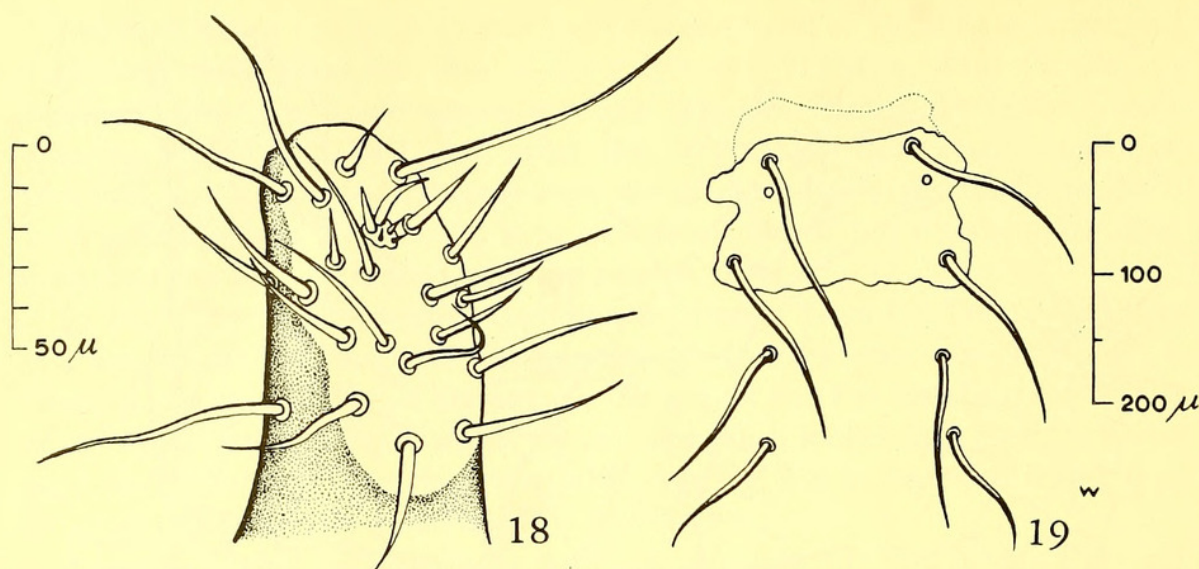
F e m a l e. Average dimensions (1350)—1390 $\times$ 820 μ . Leg I 980 μ , leg II 900 μ , leg III 980 μ , leg IV 1180 μ . These measurements are rather constant in my material. One population (Tamandjaja) measures 1430—(1470) $\times$ 860 μ , another one (Sindanglaja) has legs of resp. 860, 820, 900, and 1060 μ .



Dinogamasus macrotrichus spec. nov. fig. 15, leg I dorsally; fig. 16, leg II dorsally; fig. 17, leg III dorsally with ventral hairs indicated. (B. WEIJDE del.)

Dorsum. Dorsal shield with fine hexagonal fields of $16\ \mu$, arranged radially at the insertion of the hairs. The median area bears some 15 pairs of mostly curved hairs, about $65\text{--}70\ \mu$ in length. The number of these hairs is not absolutely constant and their grouping is not entirely symmetrical. Along the margin of the shield and on the bare skin are some 70 pairs of rather regularly and not densely inserted, slender and flexible hairs of $125\text{--}170\ \mu$ which become more curved on the distal part of the body.

Venter. The sternal shield (fig. 19) is rather well confined, and has irregular margins and pentagonal or hexagonal fields. It bears the usual four hairs, each $180\text{--}200\ \mu$ long, and has sometimes one or two pores. The third sternal hairs are somewhat shorter ($165\ \mu$). The metasternal hairs are only $125\ \mu$ long. The genital shield is $275\text{--}300\ \mu$ long and widest posteriorly. The anal shield is $270\ \mu$ long and widest at the level of the anal pore ($180\ \mu$). The two adanal hairs



Dinogamasus macrotrichus spec. nov. fig. 18, sensorial area of tarsus I; fig. 19, sternal area. (B. WEIJDE del.)

on the shield and the postanal hair are 110—120 μ long. Behind the genital shield and around the anal shield are about 15 pairs of flexible hairs, 200—240 μ long.

Legs. Legs I and II are stronger than legs III and IV. Leg I bears blunt cones and rather stiff hairs as depicted in fig. 15. Ventrally there are short, finely pointed, normal hairs. In fig. 18 I have depicted the sensorial area which perhaps may prove to be of systematic importance. Leg II bears blunt cones and various hairs as depicted in fig. 16. Its ventral hairs are rather long, mostly strong, and all sharply pointed. Leg III. All hairs sharply pointed, rather long or even long, as depicted in fig. 17. Only femur III has dorsally two short hairs. Leg IV. About the same type as leg III, but there are dorsally more rather long and less long hairs. The length of the hairs is variable, also within the population; even the left leg and the right leg of the same specimen may show differences. The coxal spines show the usual enlarged and sharply pointed type. The relatively long spine of leg IV is gradually attenuated into a long, sharp ending.

Holotype and 8 paratypes: ♀, from *Koptortosoma aestuans* (L.), S.W. Java, Pelabuan Ratu (Wijnkoops Bay), Karang Hawu, 30.IV.1932, J. VAN DER VECHT. **Paratypes:** from 5 of *K. aestuans* (L.), labelled: Strait Sunda, Krakatau I. (Pulu Rakata), 23.VI.1955, A. M. R. WEGNER (7 mites); P. Sangijang (Dwars in de Weg), 9.VI.1955, A. M. R. WEGNER (6 mites); W. Java, Sindanglaja, 1200 m, VI.1936 (5 mites); W. Java, Tamandjaja, 10.XII.1958, A. M. R. WEGNER (6 mites). Holotype (slide) with host bee and 2 paratypes (do.), in the Rijksmuseum van Natuurlijke Historie, Leiden; paratypes (slides) and 2 host bees, in the Zoölogisch Museum, Amsterdam.

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