Description of Brachypelma annitha n. sp. and Brachypelma hamorii n. sp. males and females, new species close to Brachypelma smithi (Cambridge, 1897) from Mexico. Study and taxonomic relationships of the two species and comparison with Brachypelma auratum (Schmidt, 1992), B. boehmei (Schmidt & Klass, 1993), B. emilia (White, 1856) (Araneae, Theraphosidae, Theraphosinae).
Part 1.

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Abstract:

Brachypelma annitha n.sp. and *Brachypelma hamorii* n.sp. (Mexico) show morphological differences with *B. smithi* although visually closer to the latter. Spermathecae and copulatory organs of males are food for thought. Indeed, if the spermathecae of *hamorii* are distinct, those of *annitha* are not. On the other hand, in the copulatory organs and tibial apophysis, the opposite is true: where the bulbs and tibial apophysis of *annitha* are distinct from *smithi*, in contrast those of *hamorii* are similar to the latter making it possible to consider including these as a subspecies in the genus.

DERIVATIO NOMINIS:

Brachypelma annitha: in friendship for Mrs Annita CARON of the Pasteur Institute of Lille.
Brachypelma hamorii: name given anonymously to this species.

Other species of the genre

Brachypelma smithi (Cambridge, 1897), *B. emilia* (White, 1856), *B. boehmei* (Schmidt & Klass, 1994), *B. klaasi* (Schmidt & Krause, 1994), *B. auratum* (Schmidt, 1992), *B. albopilosum* (Valerio, 1980), *B. sabulosum* (Cambridge, 1897), *B. angusta* (Valerio, 1980), *B. vagans* (Ausserer, 1875), *B. baumgarteni* (Smith, 1993).

I. GENERAL INTRODUCTION:

For several years, *Brachypelma smithi* has been considered as one of the queens of the former subfamily Grammostolinae, however several variants of this species were known, but due to a lack of work (fortunately made since), they were regarded as *smithi*. Species such as *B. auratum* described by G. Schmidt in 1992, *B. baumgarteni* by Smith in 1993 and *B. klaasi* by Schmidt and Krause in 1994 are indeed distinct species. There are other variants in *B. smithi* and if *B. boehmei* and *B. auratum* are visually remote, *B. annitha* n.sp. is relatively close, although lighter and paler with a greater pilosity than *smithi*. On the other hand, *hamorii* is closer to *smithi* although the patellae turn red with orange shaded zones; while in the male, if differences exist at the systematic level with *smithi*, palpal organs and tibial apophysis are practically identical. It is these new species, gracefully donated for these works by Dr Marie-Louise Célérier to the laboratory of one of the authors that we are going to discuss.
This leads us to ask questions: we have arrived at the same conclusion as Dr. G. Schmidt, who in 1993 created the genre *Brachypelmides*, but A. Smith refuted this for reasons regarding the spermathecae of *B. klaasi* as Dr. G. Schmidt had not included reasons of significant differences in this new genus. Dr. G. Schmidt also points out (personal communication) that the genus is particularly complex. A. Smith also states that he would also consider establishing subspecies among the

Theraphosidae and I think the same thing especially among Avicularinae (while some still exist, but are very limited: *Avicuiaria. a. variegata*, *A. fasciculata clara* for example). The problem is that to create a subspecies again one would need to know what is a distinct species or "mother" and what subspecies can get included. This brings us to crosses between each variety in both directions, because the species should normally be separate, so if the female accepts the male, to give only a sterile egg sac or nothing at all (or simply refuse the male with or without aggression). One can attempt as one of us has done in the Araneomorphae (in particular the *Latrodectus*) to refer to specific morphological characters to identify the distinct species in Theraphosidae (Tesmoingt, 1996).
We can see well, the complexity of the material and systematics, as it is very evident that many criteria must be corroborated. The problem is over, but the entry of subspecies in Theraphosidae is logical and now even indispensible. Finally, some systematic criteria does not necessarily resemble a similar visual appearance, it happens that some of these criteria are far apart: for example, on *B. hamorii* n. sp. if the coxae of pedipalps and in particular the upper edge is close to *auratum* and the layout and orientation of sigillae is close to *smithi*, by contrast the spermathecae are closer to *boehmei*.
It was not possible to work on *B. klaasi* and *B. baumgarteni* due to lack of material and so for these two species we refer to what has already been described.

II. MATERIAL AND METHODS:

For various systematic comparisons and descriptions, there was used, 4 moults of *B. annitha*, a male in alcohol at 60°, and a female that died shortly after moulting, 2 moults of *B. hamorii*, a dead female also in moult (unfortunately parasitized by Diptera) and a male in alcohol 60°, 2 moults of *B. boehmei*, a moult of *B. emilia*, a moult of *B. auratum*, 2 moults of *B. smithi along* with a dead male. Scores of macro and micro-photographs were taken, the macro-picture was taken by F. Cleton, with a 24x36 Nikon camera with a Sigma 90 MAS lens, a Metz CT32 flash, Fuji 100 film. Regarding the micro-photo, M. Tesmoingt took it with an Olympus OM2 SP equipped with a T-ring and a tele-converter on Agfachrome film and Ektachrome on stereoscopic microscope.
Paper prints were made in order to make comparisons on tracing paper and overlays of different species.
Moults were placed in a “ramolissoir” and cut up from their majority. The spermathecae were placed in hemolysis tubes containing alcohol at 60° for one hour. The prosomas were contained in petri dishes for examination under a stereo-microscope.
The living material is composed of *B.emilia*, *B. boehmei*, *B.auratum*, *B. smithi* and *B. annitha*, kept in dry terrarium habitats at 65-70% relative humidity with an average temperature of 24-25 °C
For the examination of dead specimens and certain body parts, hair removal by scraping was necessary. The spermathecae of dead specimens either preserved in alcohol or not were also collected (one can indeed easily take the spermathecae of a dead and dry animal, obviously in good condition and not parasitised). In addition, we noted that photographs may not be published, so the number of drawings has been increased. It is certain that in case of controversy, we are always ready to show these if a request is made (specific request and reason). Finally, the animals described are from the laboratory of Dr. ML. Celerier: the strain *B. annitha* came from the home of Mr Reischtener, the strain *B. hamorii* came from M. Tesmoingt then transferred to ML. Celerier for research. The origin of this strain comes from R. Hennig (USA) which could explain some similarities with *smithi* in that one does not know precisely whether a crossing between *smithi* and another species has been carried out and only the presence of this variety in their terrain demonstrates it belonging to a distinct species conclusively, which is not so far demonstrated in absolute terms.

III. VISUAL DESCRIPTION OF BRACHYPELMA annitha n.sp.

Dorsal side:
Periphery of prosoma: cream hair drawing around yellow with two demarcated tracks on either side of the eye area to the cephalic ridges forming the fovea. Several blackish tracks interspersed with cream hairs forming radiating streaks; shape of the fovea close to *boehmei* (see Plate 1, Figures: L1a to L1f) and *emilia*. Trochanters cream, except the pedipalps which possess more gray hairs. The femurs of leg I and leg IV are black, the patella of leg I and leg IV are orange drawing around red with light transverse bands on the smaller joints. The tibia of leg I are black (1/3) and light orange, the leg II and leg III half black, the rest light orange, leg IV orange (1/4) and the rest black; Tarsi on all legs are black.
Stronger hair is recognized in the legs compared to *smithi* in particular.

Ventral side:
On the ventral side, sternum, coxae (except leg I and leg IV: black) and pedipalps are brown, and the trochanters and femora are black, and the patella are lined with creamy orange hair (pale reflections) and tibia are 2/3 black, the metatarsals and tarsi are black and interspersed with light orange transverse bands.

IV. VISUAL DESCRIPTION OF BRACHYPELMA hamorii n.sp. :

Dorsal side:
The periphery of the prosoma is composed of cream hair and a denser area in the posterior margin, the rest of the prosoma is black and runs past the fovea while in *smithi*, the black area stops at the fovea. This can be compared with the prosoma of *auratum* for contrast, the profile is similar to *smithi*. The edges of the coxae and trochanters are cream with orange hairs, those of the pedipalps are equipped with silvery gray hairs, the femora are black with a small cream orange transverse band at the intersection of the patella. These have a red orange "flame" divided by black lines very distinct compared to *smithi* and *annitha* and a cream orange zone with gray hairs.
The tibiae of leg I are furnished with cream-coloured hairs with russet-red sheen (1/3), those of the leg II are black (2/3) the remainder being cream: the tibia of LIII are cream (1/4) and black and those of leg IV are cream (half) and black. The tarsi of the four legs are black.

Ventral side:
The coxae of the pedipalps and labium are brown, the hairs of the mouth are orange red. The legs are black with whitish transverse bands on the patella, the tibia and metatarsals, the latter having orange hair. The intersections of the metatarus-tarsi are fortified with a tuft of orange red hair, the sternum is black.

V / GENERAL DESCRIPTION AND COMPARISONS:

A / MORPHOLOGICAL ELEMENTS OF *B. annitha* n. sp.:

Eye Area:
- Body length: 60 mm, with a leg span of 145 to 150 mm.
- Abdomen: 25 x 22 mm
- Prosoma: 26 x 23 mm
- AO x MFV BP: 14 mm
- Main spinnerets: 10 and 11 mm

The prosoma is close to *auratum* and *boehmei*. The fovea is close to *boehmei*. The contrasts of the prosoma are variable but the main areas of contrast (especially the cephalic ridges) are present (Plate 1, L1).
The eye area is wider than long (2.8 x 3.1 mm,) (Fig. 2, Plate 3).
- Diameter of eyes: AME 0.6 mm, ALE 0.5 mm, PLE 0.5 mm, PME 0.3 x 0.2 mm.
- Differences between the two lateral edges 0.7 mm, between the two AME 1.2 mm.
- Center of AME to the lateral edge 0.23 mm.
- ALE are larger than the PLE.
- Clypeus 0.6 mm, from the inner side, 0.5 mm, from the dorsal side.
- Distance between the PLE and ALE: 2.7 mm.
- Distance from the posterior edge of AME and the anterior edge of PME: 0.3 mm.
- Distance from the posterior edge of PME and the anterior edge of ALE: 0.1 to 0.2 mm.
- Distance between the two front edges of ALE: 2.1 mm.
- Posterior edge of ALE and anterior edge of AME: 0.4 mm.
- Differences between the two lateral sides of PME: 1.6 mm.
- Differences between the two posterior edges of PLE: 2.4 mm, (Plate 4, fig. 1).

Labium and sternum:
The sternum is composed of three pairs of sigillae. The LI and LII are approximately the same size and ovoid: on the other hand, as in many other *Brachypelma* in study, LIII is larger and oval. The distance between the sigillae to the edge of the sternum as well as its orientation, can be considered as a more or less reliable criterion but nevertheless not significant: LIII is farthest from the edge of the sternum and orientated towards the labium. Its location is within the limit of the LIV (Fig. L4, 1-6) whereas for LI, LII, they are oriented toward the posterior border of the sternum and mid-LI, LII. For the dimensions of the prosoma cited above, the differences between sigillae are as follows; 2. 1 mm for the distance to the edge of the sternum, LI: 0.8 mm, LII: 0.9 to 1 mm, LIII: 1.5 mm (see Pl.4, fig 2) The length of sigillae by the inner side: LI: 0.5 mm, LII: 0.54 mm, LIII: 0.9 mm, for the various positions and orientations of the other species sigillae see Pl.1, L4. 1 to 6.
The labium (3.7 X 4.8 mm) is wider than long (see Pl.5, fig. 8). The density of granules (or cuspules) is close to *smithi* and *hamorii*, as to the shape of the labium, it is close to *hamorii* although the latter is wider (see Pl.1, L3. 1 to 6).
The cheliceral teeth are composed of a series of 8 or 9 teeth of varying shape and size from one tooth to another (see Pl.5, fig 4), the length of the chelicerae is 14 mm (extracted from the prosoma). 9 teeth on these, there are 2 large, 3 medium and 4 small.
For coxae of the pedipalps and of the LI, see Pl.1, fig L2, 1-6.
Spermathecae and the seminal receptacle are close to *auratum* for the shape of spermathecae, and close to *boehmei* for the seminal receptacle (see Pl.2, Fig 4, 1, 5).

Legs:

In terms of bristles, our attention was focused on the tibia, metatarsus and tarsus of leg IV and the pedipalps.
They are equipped with stiff bristles (spines); so their number is consistent, on the other hand their layout and orientation are highly variable and do not correspond systematically with the specimens in study and the previous work; more on the same subject, number and orientation of the spines of the same leg segment on the opposite leg are often different. As a result, they are given only as an indication and can't be taken for a reliable criterion (Pl. 2, fig 4a, 4b). Yet, while on the tibiae of the pedipalps of all species studied, there are numerous stiff bristles, only *B. hamorii* possess just three on the anterior surface of the tarsus at the intersection, which is verified on other moults. It is therefore a criterion of value. It should also be noted that in *boehmei*, if differences exist on the tibiae of the pedipalps such as the orientation and disposition, however the number of bristles is the

same on the metatarsus of leg IV (it can happen that they are broken during manipulation, hence the need for hair removal by scraping). Positions of spines on the legs see Pl.2, Fig 1, 6a & 6b.
For the notation of spines of the legs, and in particular the tibiae of the pedipalps and metatarsus of leg IV, we will take that of Helsdingen, to be:
Pro: « ' », Rétro: « = », Dorsal: « d », Ventral: « v », Latéral: « l », Pair: « () », Apical: « a », Basal: « b ». This gives the formula for the tibia of the pedipalp: I = d 1, I v ' 1, v 2, v a (1), I a 2. Metatarsus of leg IV: v (4), or v (2-2-2-2), I = 3, v b 1, I' a 2, v a (1).

MORPHOLOGICAL ELEMENTS OF BRACHYPELMA hamorii n. sp.

Body length, 70 mm, a leg span of 150 mm. Abdomen, 30 x 27 mm.
Spinnerets: primary: 13 mm, secondary: 2 mm.
Prosoma: 27 mm.
Posterior edge of eye in the middle area of the fovea: 16 mm.
Ocular tubercle broader than long, 2.5 mm x 3.4 mm. (see Pl.3, Fig 6)
Clypeus: 0.6 mm.
Diameter AME: 0.5 mm, ALE: 0.5 mm, PLE: 0.7 mm PME: 0.4 x 0.25 mm.
Difference in AME: 1.15 mm (center to center) gap between the two lateral sides: 0.7 mm.
(Pl.9, fig 10)
Distance between the posterior edge of ALE and the posterior edge of PLE: 3 mm.
Difference between the posterior edge of the anterior edge AME and PME: 0.4 mm.
Difference between the two ALE: 2.4 mm.
Difference between the two PLE: 2.4 mm.
Difference between the anterior edge of the PLE and the posterior edge of PME: 0.1 mm.
Difference between the posterior edge of ALE and the anterior edge of the PLE: 0.2 mm.
Difference between the posterior edge of ALE and the anterior edge of AME: 0.5mm.
Difference between the posterior edge of AME and anterior edge of the PLE: 1 mm.
Note that in the ocular tubercle of moult No. 1, the PLE such as shown in the figure are disproportionate. Perhaps it is a deformity, otherwise this morphological character would become a criterion for determining this species (Pl.5, fig 2 and Pl. 4, fig 3).

The cheliceral teeth are composed of ten teeth of variable size, but more pointed than in *annitha*, the first three are tilted forward (towards the fang), the distance separating the first and last tooth is 5.5 mm for a cheliceral length of 14 mm. The cheliceral teeth consist of: 5 large, 2 medium and 3 small (Pl.5, fig 5). The sternum is composed of three pairs of sigillae (it can happen that one of them is absent or difficult to locate) in particular LIII; (Pl.5 fig 14, Pl.1, L4: 1-6). The differences are as follows: LI, LII: 2.7 mm. LII, LIII: 2.4 mm. The distances between the sigillae and edge of the sternum are LI: 0.9 mm, LII: 0.8 mm, LIII: 2.2 mm (these values are, like *annitha*, taken on the inside). The layout and orientation of the sigillae is close to *smithi* and *boehmei* (Pl. 4, figure 4).
The coxae of the pedipalps are close to *auratum* and *annitha*. (Pl.1, fig L2 :1-6) The labium is almost similar to *annitha*, but it is larger (2.5 x 4.5 mm) the density and spacing of the granules on the labium are similar to *auratum* and *annitha*. (Pl.5, fig 11 and Pl.1, L3 1-6).
The spermathecae are close to *B. boehmei*, the seminal receptacle as well. Note that in *hamorii*, the spermathecae are characteristics: they present (from 4 moults studied) a very different form to *smithi*, and are equipped with two small nodules very close together and always present which makes it an important systematic criterion (Pl.5, Figs 17, 17a, and Pl.2, fig 3).
Spines: Palpal tibia: v b 2, I a 1. Met leg IV: v (1), I ' d 1, I = 1, v 1, I ' a (1), v a (1). (PL; 2, fig 3 a, b, c and Pl.6, fig 1-9)

Values of the sections of the legs of B. annitha:

Prosoma: 23 mm. Sternum, 11 x 8 mm (measured at LII).

	COX	TR	FEM	PAT	TIB	MET	TAR
L I	11	4	17	10	15	13	8
L II	9	4	16	10	13	12	8
L III	8	4	14	10	11	14	8
L IV	9	5	17	10	14	19	8/9

Total length of the legs: LI: 78 mm LII: 72 mm, LIII: 69 mm, LIV: 82 mm.
Pedipalps: COX: 7/8 mm, TRO: 3 mm, FEM: 12 mm, PAT: 7 mm, TIB: 10 mm, TAR: 9 mm, total length: 48/49 mm.
Relations between the sections of the legs of *B.smithi* are confirmed for *B. annitha*.
TIB LI + TARS LI (LII, LIII, LIV). TIB LII + PAT LI (LII, LIII, LIV). MET LI + PAT LI (LII, LIII, LIV). MET LII + TIB LIII.

Values of the sections of the legs of B. hamorii:

Prosoma: 27 mm. Sternum: 12 mm.

	COX	TR	FEM	PAT	TIB	MET	TAR
LI	10	5	18	10	13	12	8
LII	10	4	16	9	12	11	8
LIII	9	5	14	9	10	13	8
LIV	10	5	17	10	13	-	8

Total values of the legs: LI: 76 mm, LII: 70 mm, LIII: 68 mm, LIV: metatarsus missing in both legs.
Pedipalps: COX: 7 mm, TRO: 4 mm, FEM: 13 mm, PAT: 7 mm, TIB: 9 mm, TAR: 10 mm, total length: 50 mm.
The relations between the sections of the legs mentioned above do not apply to *B. hamorii*, for this species they are as follows:
FEM LI + PAT LII (LIII). MET LIV + PAT LII (LIII). MET LIV + TARS LII. FEM LIV + PAT LIV (LI). TIB LI + MET LIII. TIB LIV + MET LIII. FEM LIII + TIB LI (LIV). FEM LIII + MET LIII.

Values of the sections of the legs on the second exuviae of B. hamorii:

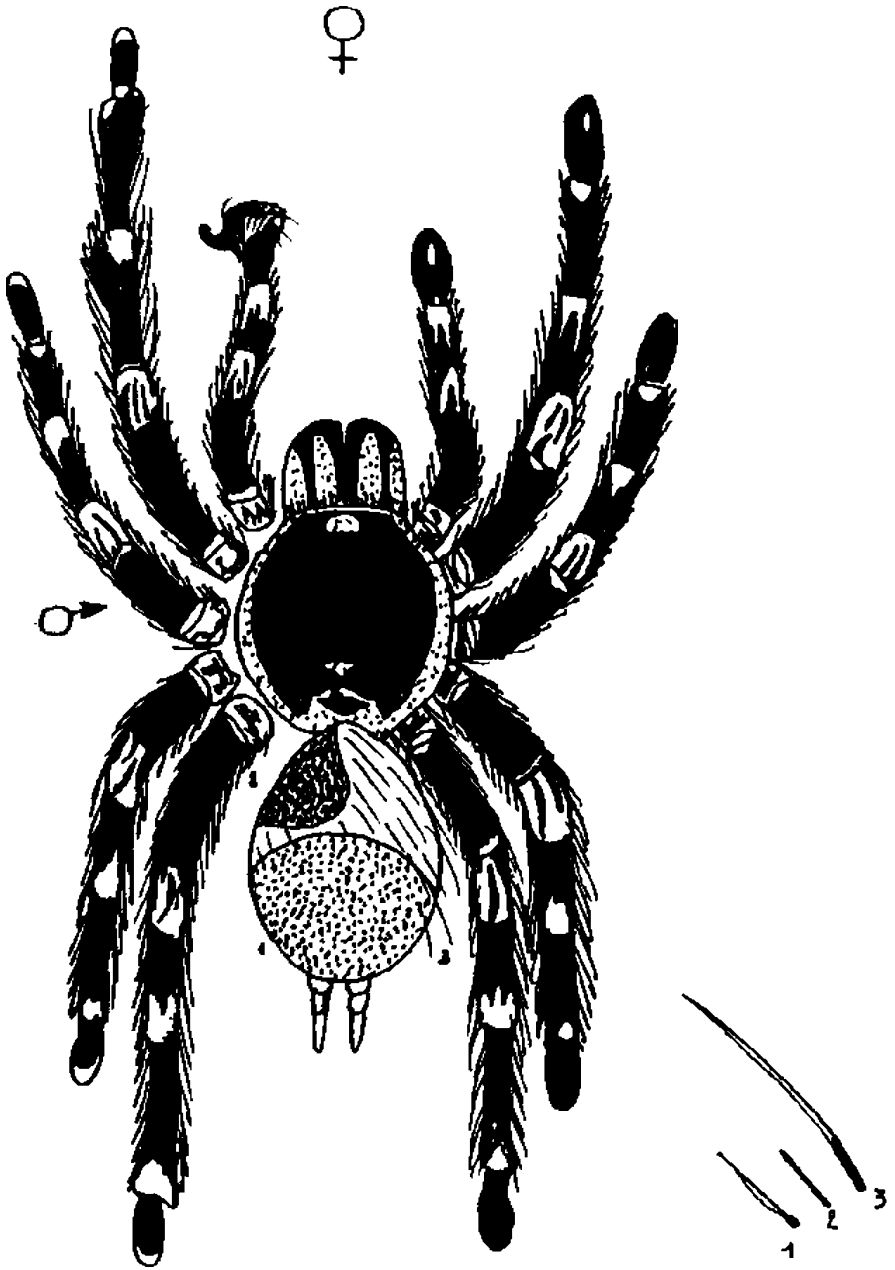
	COX	TR	FEM	PAT	TIB	MET	TAR
LI	10	4	17	10	13	12	8
LII	9	4	15	9	12	11	8
LIII	8	4	13	9	10	13	8
LIV	10	4	16	10	13	17	8

Total length of the legs: LI: 74 mm, LII: 68 mm, LIII: 65 mm, 78 mm LIV.
Pedipalps: COX: 8 mm, TRO: 2 mm, FEM: 13 mm, PAT: 7 mm, TIB: 9 mm, TAR: 8 mm
Total length: 47 mm.
The relations cited above are equivalent with the addition: FEM LIV + TIB LIII.

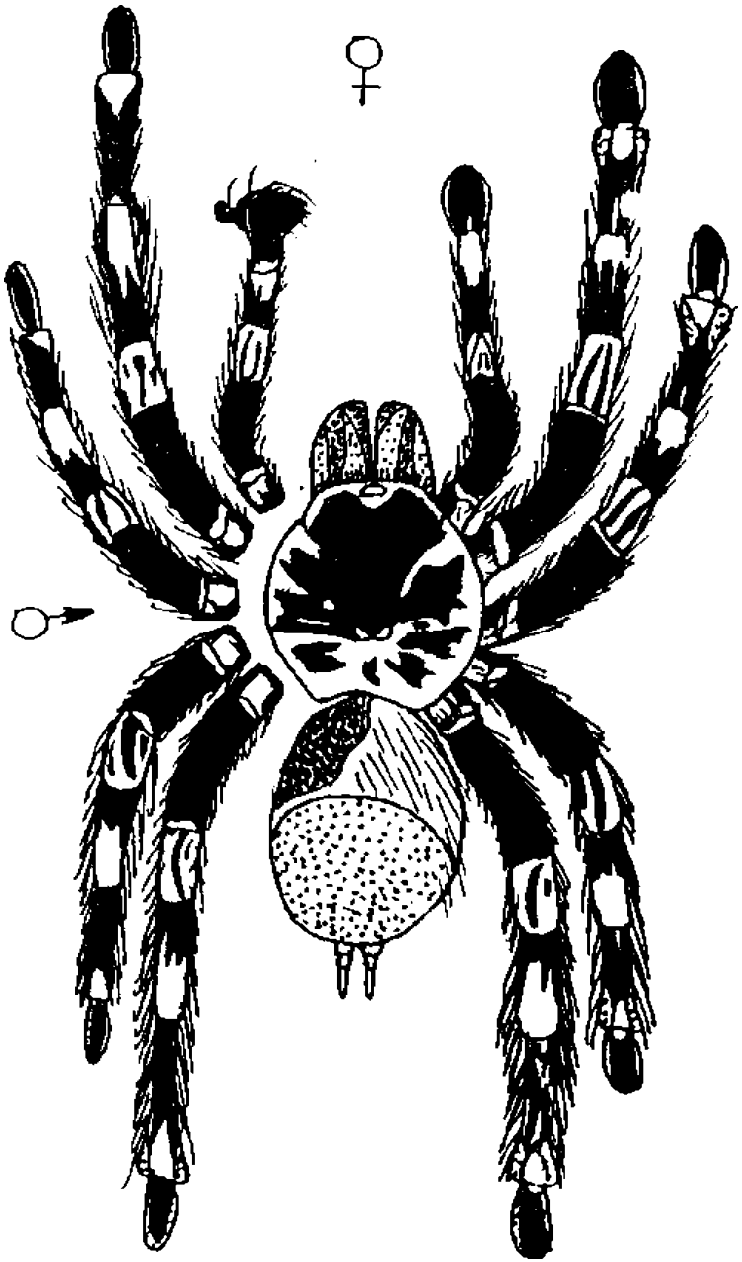
General data on the specimens:

	LG PR	LG ST	LG CH	CLYP	F/AO	AO
B. annitha	26	11	14	0.5/0.6	14	2.8/3.0
B. hamorii	27	12	14	0.3	16	2.5/3.4
B. emilia	26	11	13	0 2/0.3	14	2.0/2.7
B boehmi	28	12	15	0.5	14	2.6/3.1
B. auratum	27	12	14	0.5	14	2.4/3.1
B. smithi	28	12	15	3.5/4.0	15	2.7/2.9

B. hamorii



B. annitha



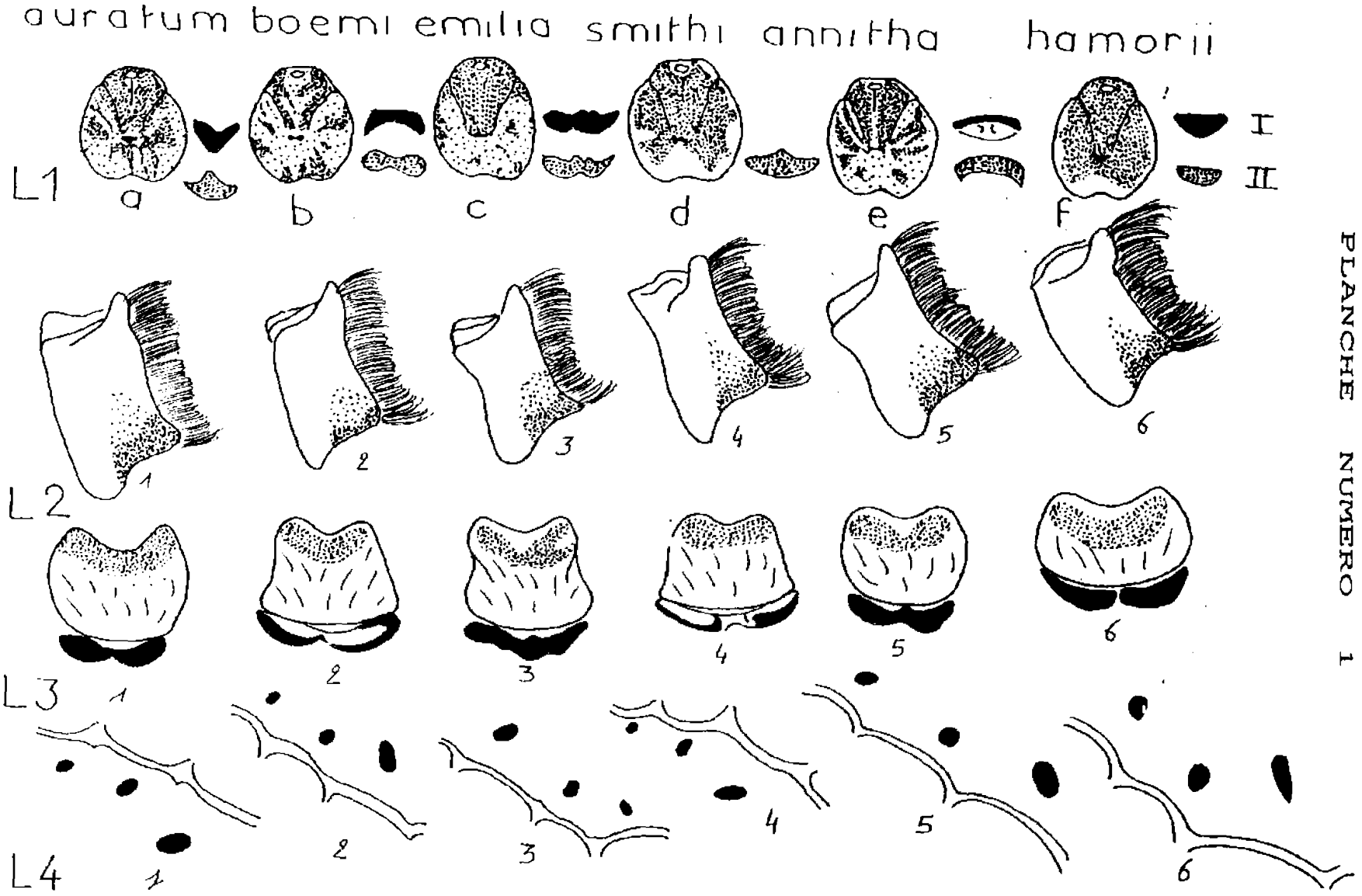
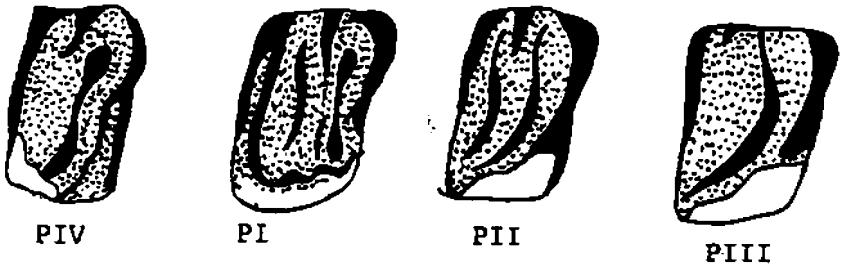


PLANCHE NUMERO 1

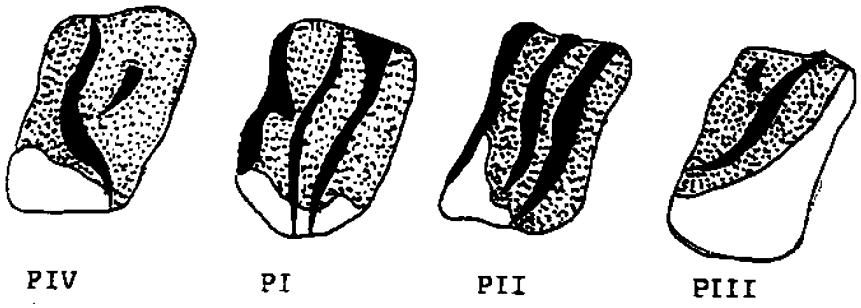
Plate No.1 Legend

Line 1: Representation of the prosoma and of contrasts on the subjects in study La - Lf visual presentation of the foveas under transmitted illumination (I). II Under stereoscopic microscope. Line 2: Coxae of the pedipalps. position and density of the granules Line 3: Labium, shape and density of the granules. Shapes of the labio-sternal sutures Line 4: Position and orientation of the sigillae

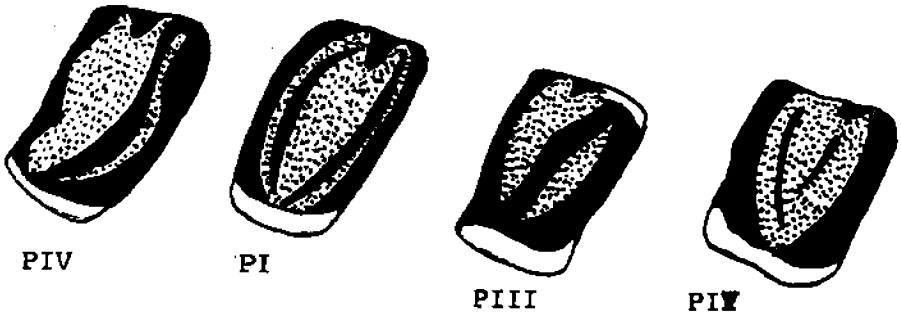
B. hamorii



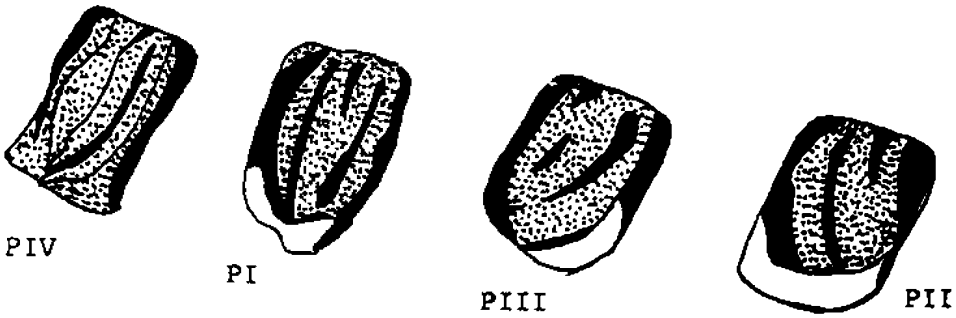
B. annitha



B. auratum



B. smithi



CONTRASTS OF THE PATELLAE OF DIFFERENT SPECIES OF BRACHYPELMA.

Black Orange, Red Cream

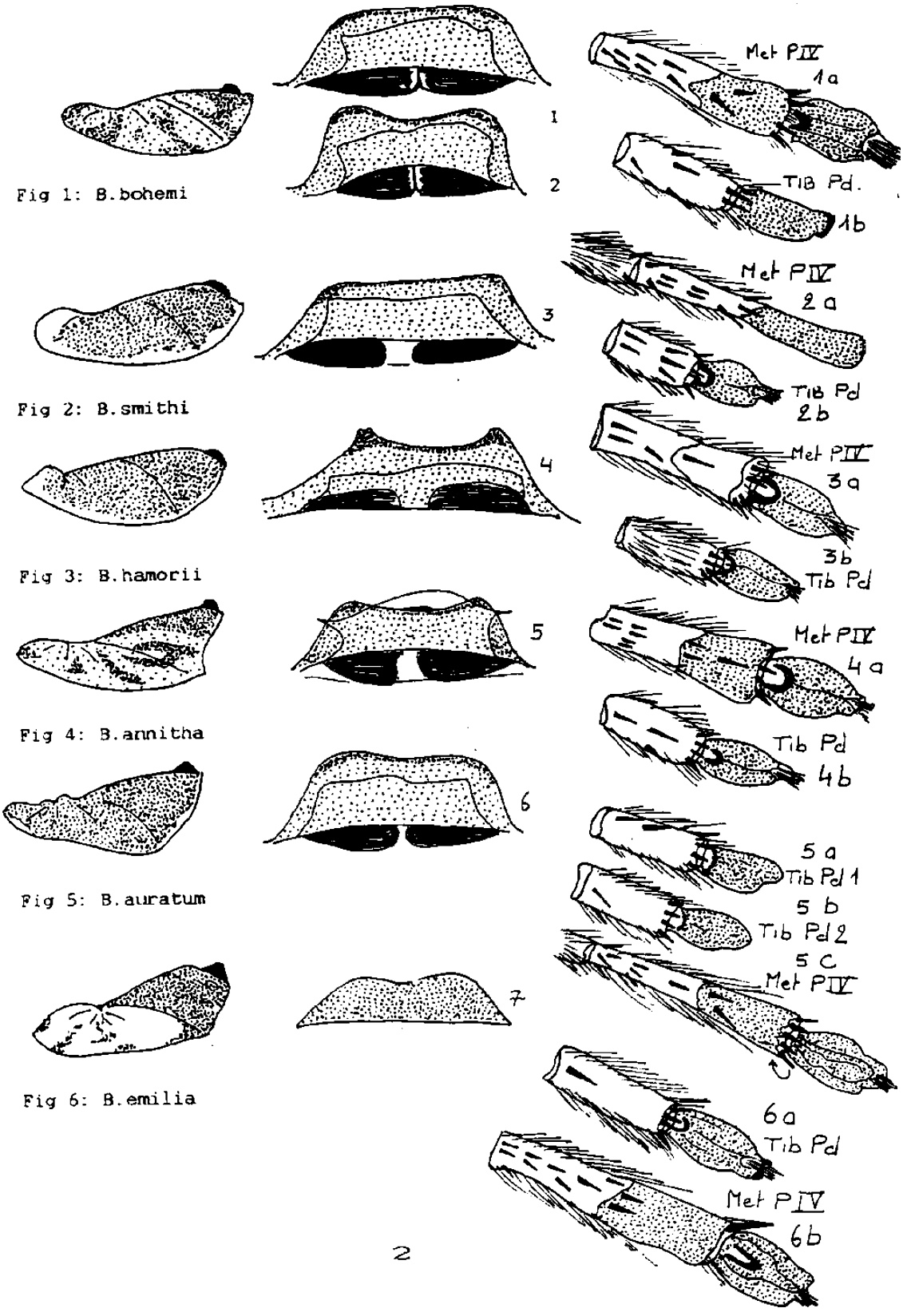
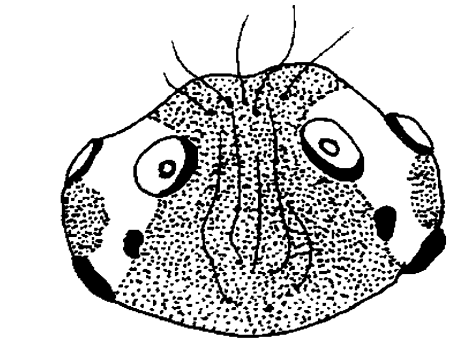


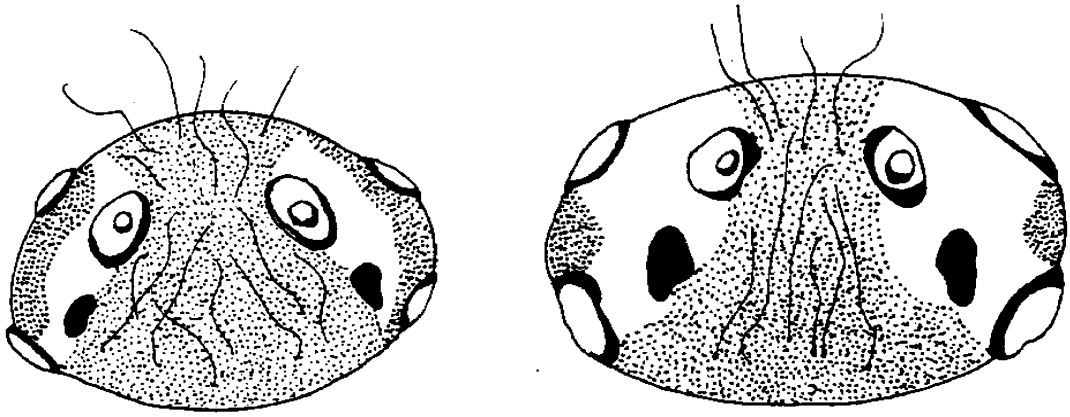
Plate no. 2 Legend

Lines 1-6: Profiles of prosoma with contrast, spermathecae. tibiae of the pedipalps, metatarsals of LIV. Line 1 NA, NB. two aspects of the spermatheca of *B. boehmei*.

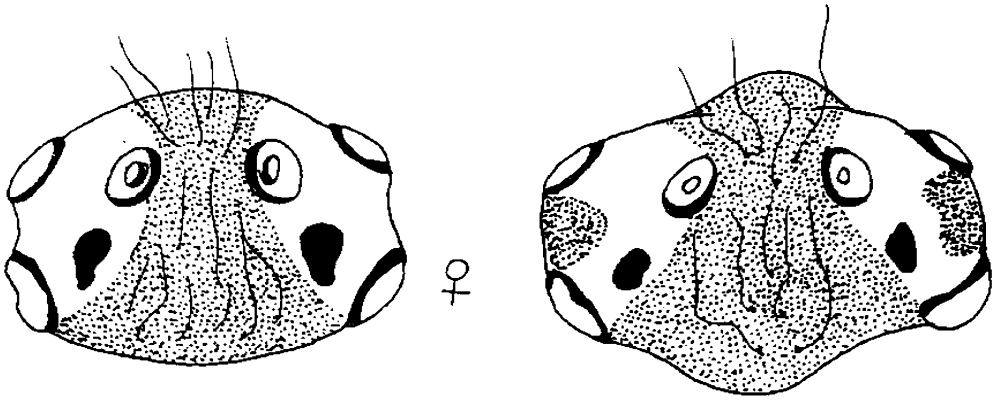
OCULAR TUBERCLE: Visual appearance. Plate no. 3



1. B. smithi ♀ 2. B. annitha



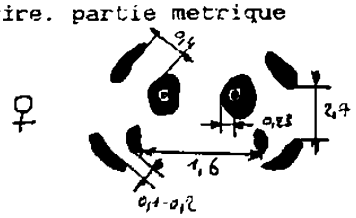
3. B. emilia ♀ 4. B. bohemi

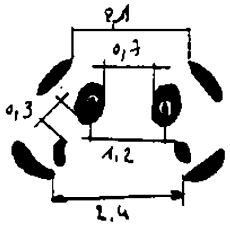


5. B. auratum 6. B. hamorii

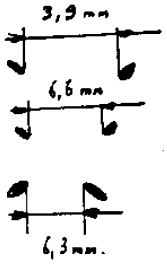
BRACHYPELMA annitha Femelle

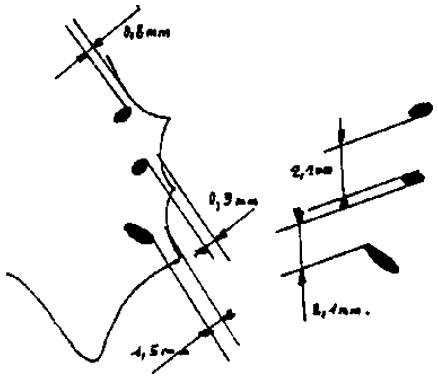
1. Aire oculaire. partie metrique





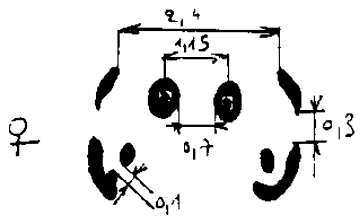
2. Sigilles: partie métrique

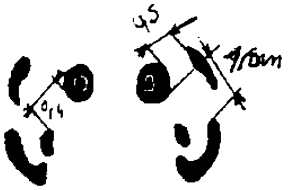




BRACHYPELMA hamorii Femelle

3. Aire oculaire; partie métrique





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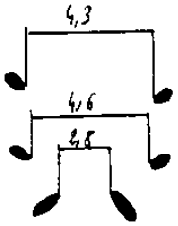
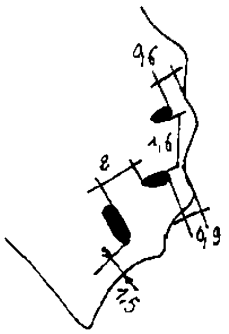
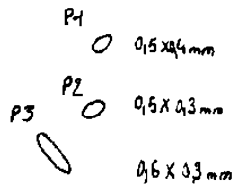
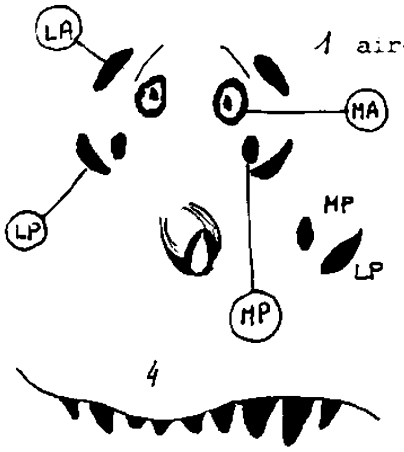






FEMELLES

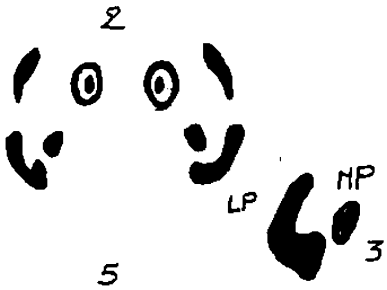
B. annitha

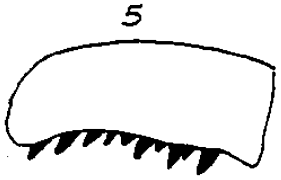


1 aire oculaire

4

B. hamerli



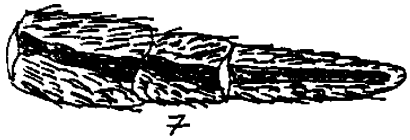


5

Rateau des chélicères

6

Filières



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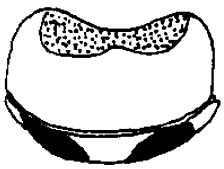
Labium 8

Labiosternum 9



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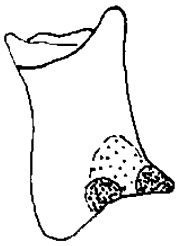
sternum sigilles



Coxa palp 12

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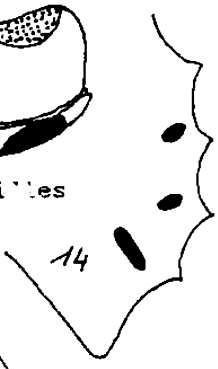

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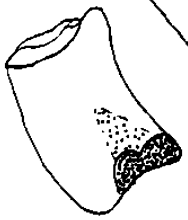
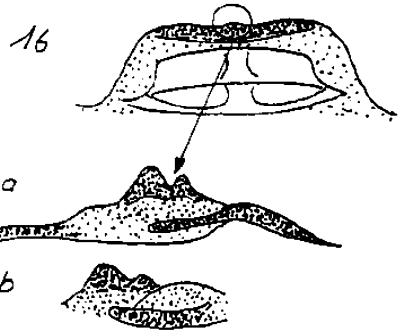
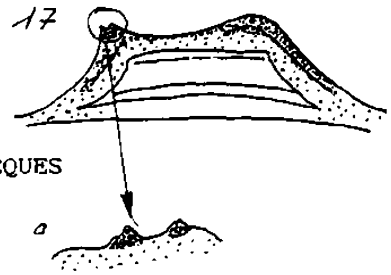
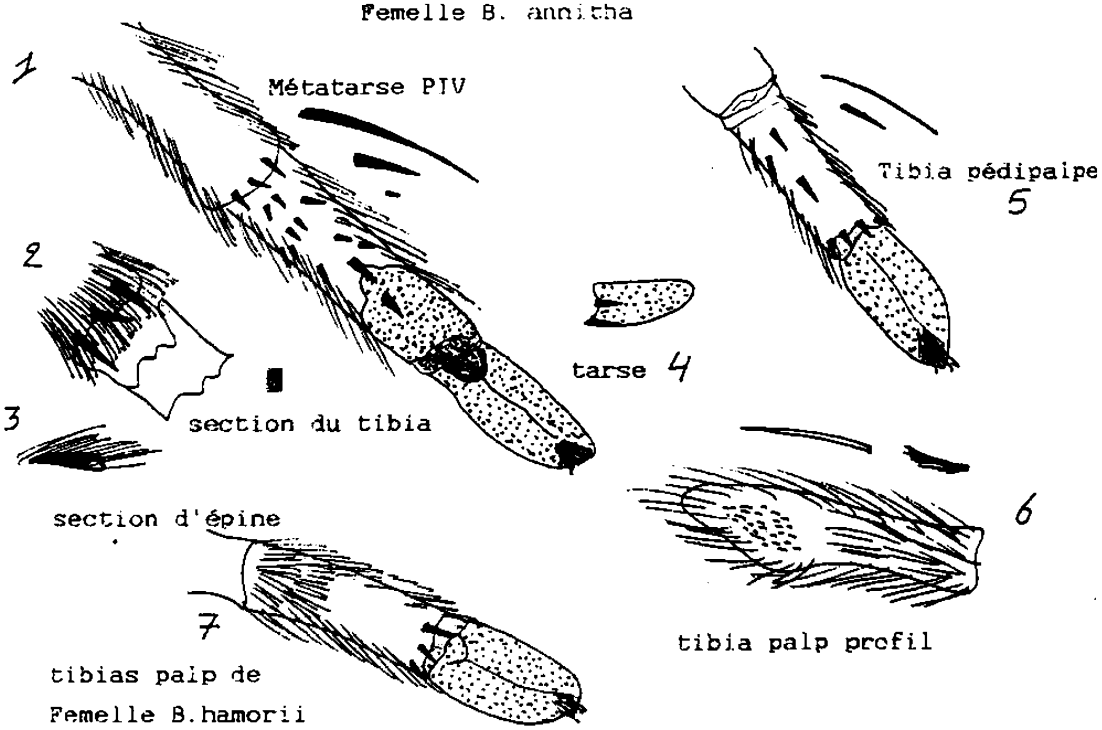


coxa palp 15





Femelle B. annitha



Femelle B.hamorii