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Copulatory mechanisms in *Zelotes*, *Drassyllus* and *Trachyzelotes* (Araneae, Gnaphosidae), with additional faunistic and taxonomic data on species from Southwest Europe

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Mating mechanism in *Zelotes*, *Drassyllus* and *Trachyzelotes* are described from dissected organs of cryo-fixed and freeze-dried pairs *in copula*. The male tibial apophysis is used as primary anchoring device to the anterior epigynal pocket. The pedipalpal median apophysis (retinaculum) used as a functional conductor is discussed. The embolar complex includes embolar base and terminal apophysis if present. In all Zelotinae studied the embolus is connected to the posterior tegular base by a strong sclerite the "embolar radix". A possible synapomorphy in true *Zelotes* is the presence of a posterior sclerite linking the terminal apophysis to the posterior tegular base and embolar radix.
The following species are placed in synonymy: *Zelotes brignolii* Di Franco & Pantini = *Z. sardus* (Canestrini). *Zelotes donnezanus* Denis and *Z. silvicola* Denis = *Z. cyanescens* Simon; *Zelotes declinans* (Kulczyn'ski) and *Z. labilis* Simon = *Z. segrex* (Simon); *Zelotes louronensis* Denis = *Z. apricorum* (L. Koch); *Zelotes adolescentulus* Denis, *Z. lugens* Denis and *Z. massiliensis* Soyer = *Z. ruscinensis* Simon; *Zelotes pseudoclivicolus* Grimm = *Z. gallicus* Simon; *Zelotes reconditus* Simon = *Z. egregius* Simon. The female syntype of *Z. callidus* (Simon) placed in *Z. caucasius* (L. Koch). Lectotypes are designated for *Z. egregius* Simon and *Z. reconditus* Simon.

Key words: Araneae, Gnaphosidae, copulation , mating mechanism, taxonomy, zoogeography.

INTRODUCTION

The comprehension of the functional mechanism of the highly complex male genital organ may help to clarify systematic relationships in spiders.

In 1996 I was able to observe the *copula* of a pair of *Drassyllus praeficus* (C.-L. Koch), in 1998 that of *Zelotes caucasius* (L. Koch), in 1999 that of *Z. fuscorufus* (Simon) and *Z. sardus* (Canestrini), and in 2000 that of *Trachyzelotes pedestris* (C.-L. Koch) and *T. lyonneti* (Audouin). After a collecting trip to the Pyrenees, in an attempt to find males of Denis's species, observation of the *copula* of *Z. aeneus* (Simon), *Z. apricorum* (L. Koch) and *Z. petrensis* (C.-L. Koch) were made in 2001. All mating pairs were cryo-fixed and their copulation mechanisms later studied in detail.

MATERIAL AND METHODS

Inadult spiders were reared in individual plastic boxes. Small boxes (diameter 35 mm, height 20 mm) were used for copulation observation The couples were left separated by a fine nylon mesh for some time and subsequently put together. During observations under a dissecting microscope, the box was covered by a large cover glass, which was removed during mating. All the females were virgin before mating.

Cryo-fixing during copulation was achieved with an industrial medium used for testing electronics, i. e. "Givrant 50" made by Siceront KF, France. The liquid was poured over the mating spider, which were then placed in a freezer. Later, this material was freeze-dried in a freezer under vacuum and in the presence of a drying agent.

The specimens were dissected while taking pictures at each stage; some parts were prepared for SEM observation.

Except for the freeze-dried material, all vulvae were treated with sodium hydroxide and with pyrogallic acid, which gives a fine and reversible stain to the cuticle. Objects were cleared in lactic acid and placed on a microscope slide with a well for observation.

Inadult specimens collected were reared till the last moult and that date was added to the date of capture.

OBSERVATIONS

Basic structure of the male palpal organ in the observed Zelotinae

Tegular base: dorsal belt-like structure linking the subtegular haematodocha to the tegular one (Figs 1a, 26, 29, 39), containing the spermophore.

Embolar radix: primary base of the embolus in all Zelotinae studied, is connecting the embolus to the tegular base (Figs 1a, 1d, 14, 29, 39).

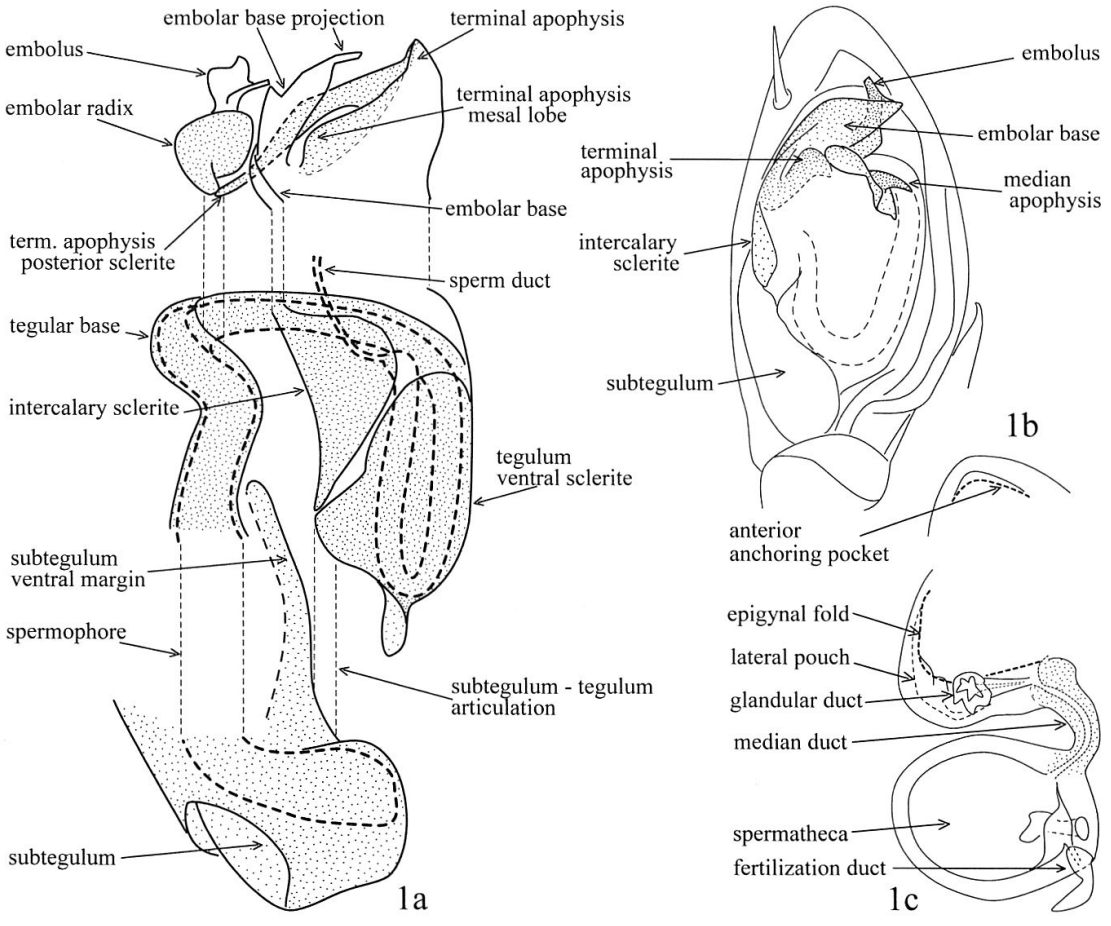


Fig. 1a: *Zelotes*, diagram of left male palp, prolateral view; 1b-c: *Zelotes fuscorufus*; 1b: Left male palp, ventral view; 1c: id., left side of vulva, dorsal view.

Terminal apophysis: in *Zelotes* (except *Z. caucasius*) the terminal apophysis is linked to the tegular base by a posterior sclerite (visible only in the expanded bulbus, Figs 1a, 11-14, 20), a possible synapomorphy of true *Zelotes*. The functional apical embolar complex includes the terminal apophysis. In addition to the anterior articulation of the intercalary sclerite and the posterior articulation of the terminal apophysis, the embolar radix is connected to the tegular base in superposition to the terminal apophysis posterior sclerite (Fig. 14). During mating, the terminal apophysis appears to have a locking function through external pressure on an apophysis inserted into the lateral epigynal fold. In *Z. apricorum* and *Z. aeneus* this is caused by the terminal apophysis prolateral lobe pressing against the prolateral prong or lobe of the embolar base (Figs 4, 7-8) and in *Z. petrensis* and *Z. sardus* by the terminal apophysis against the mesal apophysis. In *Drassyllus praeficus* the terminal apophysis (fused to the embolar base) is extended ventrally to the base of the tegulum and no posterior sclerite of the terminal apophysis is present. The bifid terminal apophysis may be used during the intromission phase, but it remains free during copulation (Figs 36-37); the embolar complex *in copula* has a posterior articulation through the embolar radix and an anterior articulation with the retrolateral ventral margin of the terminal apophysis flexed along the tegulum (Fig. 38).

Median apophysis (retinaculum) (Fig. 1b) used as a functional conductor. Miller (1967) considered the retinaculum as an anchoring device to the anterior epigynal pockets. The anterior anchoring sclerite is used by the tibial apophysis as a primary anchorage of the pedipalp. In *Haplodrassus signifer* (personal observations) the median apophysis remains hooked to the lateral atrium rim below the embolus during copulation. In one mating of a disproportionate pair of *Zelotes caucasius* (Figs 26-27), the median apophysis remained hooked to the anterolateral epigynal margin. One pair of *Zelotes sardus* fixed in the intromission phase shows the embolus passing on the backside of the median apophysis (Fig. 25). These examples reveal the use of the median apophysis as a functional conductor in Zelotinae and in the genus *Haplodrassus*. In Zelotinae, the median apophysis usually becomes free after intromission is achieved.

Embolar base (Figs 1a-b) linking the tegulum to the embolus, directly or through the intercalary sclerite; in some group it has an apical **embolar projection**.

Embolar haematodocha of variable size linking the embolar radix and embolar base (except in *Zelotes caucasius*, *gracilis* group). This membranous structure has been repeatedly referred to as conductor.

Intercalary sclerite: in true *Zelotes*, this (important) sclerite attached to the embolar base directly links the embolar complex to the tegulum in true *Zelotes*. The more or less sclerotized connection with the embolar base is usually rather narrow, and so complete in the *Z. petrensis* group, that it take the appearance of a single sclerite (Figs 18, 78-79, 88). The intercalary sclerite is extended below the terminal apophysis to which it is linked by a mobile joint.

Sperm duct: connecting the spermophore to the embolus (Fig. 1a). In *Zelotes* and *Drassyllus* the sperm duct runs directly to the embolus through the tegular haematodocha. In *Z. caucasius* (*gracilis* group), it runs directly to the free embolar base.

Basic structure of the female organ in the observed Zelotinae (Fig. 1c)

Epigynum: usually in *Zelotes*, an epigynal plate is delimitated by an epigynal fold. Secondary sclerotized lateral ridges may be seen in some species (*Z. latreillei* (Simon)).

Anterior anchoring pocket: paired or unpaired pockets, with a sclerotized ventral margin; used for primary anchorage of the male tibial apophysis in the mating.

Lateral fold: opens in a vulval furrow or pouch.

Vulva: in addition to the spermathecae, it shows the following characteristics:

Lateral pouch ("lateral epigynal duct" in Platnick (1983a)): in the *Z. tenuis* group, *Z. apricorum* and *Z. aeneus* the embolar base is inserted into the pouch. These species have a type of embolus witch is not inserted into a duct, but just pressed onto an insemination pore. This insemination pore is either sclerotized and opens inside the pouch (Fig. 34, *Z. fuscorufus*, *tenuis* group) or it is membranous and opens into a secondary posterior fold (Figs 5, 7; *Z. apricorum* and *Z. aeneus*, *subterraneus* group).

Lateral furrow ("lateral epigynal duct" in Platnick (1983a)): in the *Z. petrensis* group the furrow receives the embolus leaving its membranous flap to protrude outside (Figs 11, 17, 20).

Median duct: it runs from the insemination pore to the spermatheca.

Glandular duct ("paramedian epigynal duct" in Platnick (1983a)): position depending on the type of insertion. In *Zelotes caucasius* (*gracilis* group), in which the male possesses a long embolus that is inserted, the glandular duct opens at the entrance of the vulval insertion duct. In *Drassyllus praeficus* it opens at the tip of the inserted embolus. In *Z. fuscorufus* (*tenuis* group) the male of which possesses a short embolus, the secretion duct opens in the close vicinity of the insemination pore. In the *Z. petrensis* group the short glandular duct opens at the entrance of the insertion furrow. The glandular duct is divided in two branches in *Z. aeneus* and *Z. apricorum*; the main duct opens into the lateral anchoring pouch and the secondary duct, diverging at about mid length, opens in the vicinity of the insemination pore.

Female mating refusal

In the small observation boxes the female is not able to escape from the male, a situation not existing in a natural environment. An unwilling female of *Zelotes manius* attempted to flee for about 5 min. before the male climbed on her from the front as usual; the mating attempts, with both pedipalps in alternation, lasted 45 min., until both spiders were separated. A week later a second tentative mating occurred with the same results. In copulation, the male is pulling on the side of the female abdomen with his legs, and a willing female usually turns and lifts her abdomen. The refusing female lowers her abdomen, and because of lack of space between her posterior legs, the male is unable to anchor the tibial apophysis into the anterior anchoring pocket of the epigynum. The male repeatedly tried to insert with both palps. As soon as anchoring seemed achieved, the rotation of the bulb took place. In the absence of intromission, the pedipalp returns immediately to a resting position; sometimes a cleaning of the pedipalp occurs.

Mating behaviour

The following observations are incomplete, as my goal was the cryo-fixing of mating pairs.

The preliminary actions were remarkably homogenous among the Gnaphosids studied (including *Gnaphosa* and *Haplodrassus*). The lifting of the forelegs in the male while approaching the female is a defensive attitude equally present in the female. The male carefully approaches the female with lifted anterior legs from the front until his forelegs are in contact with those of the female. At that stage, the male may move back, and as observed in *Z. apricorum*, make a series of spasmodic vibrations with the four anterior legs and get in touch again.

The male gives a series of little taps on the female forelegs, interrupted by periods of rest. When ready, the male moves forward in little jerks in the tapping intervals. Finally, the male climbs on the female and, usually excited, pulls the female abdomen to one side and attempts palpal intromission. First there is a hectic brushing of the tibial apophysis on the epigynum, and the tibial apophysis anchors in the anterior epigynal pocket. Then intromission occurs with the swelling of the haematodocha. Sometimes the male approaches the female from behind, and even attempts anchoring to the side of the cephalothorax. In this case, there is either separation or the male makes a half turn on the female and mating occurs (observed in *Z. apricorum*).

A variant was once seen with *Z. sardus* in a rear approach to the female. After getting in contact with the female, the male made a down jerk with the abdomen, followed by rhythmic jolts, while pressing on the female opisthosoma with his forelegs. This was repeated during 75 s with short periods of rest; then during 90 s the same occurred with a forward motion. During other tentative approaches from the side, the female placed herself face with the male.

The observed rhythm of the haematodocha swellings is highly variable. During swelling, there is a contraction of the legs and chelicerae and during deflation an independent cheliceral movement. In *Trachyzelotes pedestris*, swelling and deflation are about equal in length; rhythm: 1 s slowing to 2 s (observed for 25 s). In *Z. apricorum* there is a slow swelling and a very short deflation. After intromission and 30 s of rest, there is a 3.5 s swelling which slows down to 1-2 s after 40 s (observed for 65 s). In *Z. fuscorufus*, after intromission and 50 s rest, 7 rapid swellings following by a rest and 3 fast swellings, which slow down to 1 swelling/s. (observed for 22 s).

Mating mechanisms

Zelotes subterraneus group - s. str. (see Lohmander 1944)

Male pedipalps in this group are primarily characterized by the presence of a transverse embolar base bearing a more or less extensive apical projection. The embolus is linked to the embolar base by a sizable notch below the projection (Figs 2-4). In the two species examined, the embolar base is inserted into the lateral epigynal pouch with the projection more or less bent in the closed posterior part. The embolus itself is inserted directly into a secondary posterior epigynal fold, with the embolus tip pressed on the insemination pore. Terminal apophysis and embolar base are fused on their prolateral side. Embolar base and intercalary sclerite are united by a narrow more or less sclerotized connection.

Separate insertion of embolus and embolar base, as seen in *Z. aeneus* and *Z. apricorum*, may be restricted to a subgroup of the *subterraneus* group. In *Z. cyanescens* (Fig. 61; Jézéquel 1962a: Fig. 10) and *Z. erebeus* (Grimm 1985: Fig.

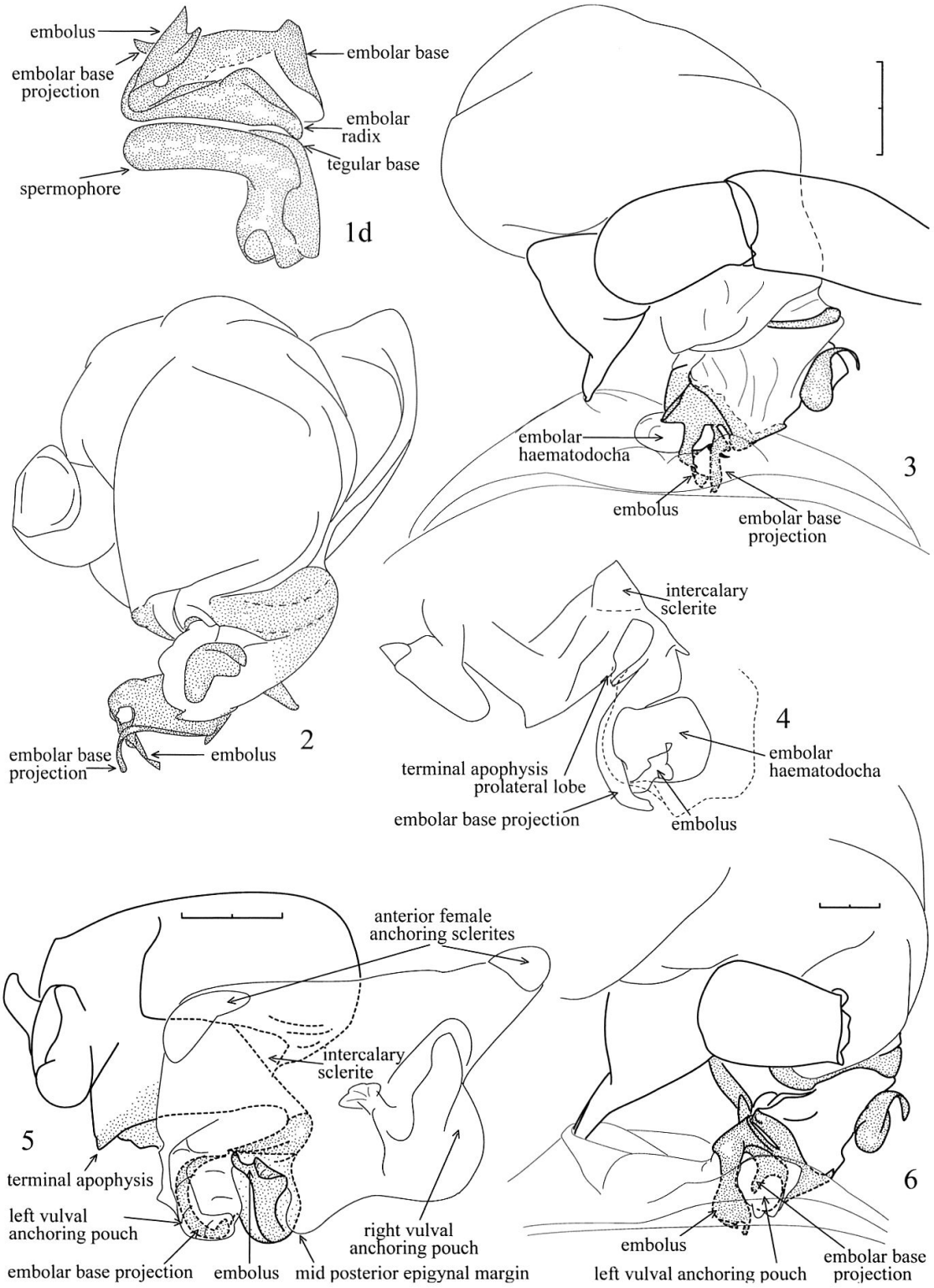


Fig. 1d: *Zelotes apricorum*; embolus-tegulum posterior articulation on a left palp in resting position. Figs 2-4: *Zelotes aeneus*, left male palp *in copula*; 2: extracted, retrolateral view; 3: id., posterior view; 4: id., embolar complex on dotted epigynum, apical view. Figs 5-6: *Zelotes apricorum*; left male palp *in copula*; 5: inserted in the vulva in dorsal view; 6: inserted, posterior view. Scale lines: 0.2 mm.

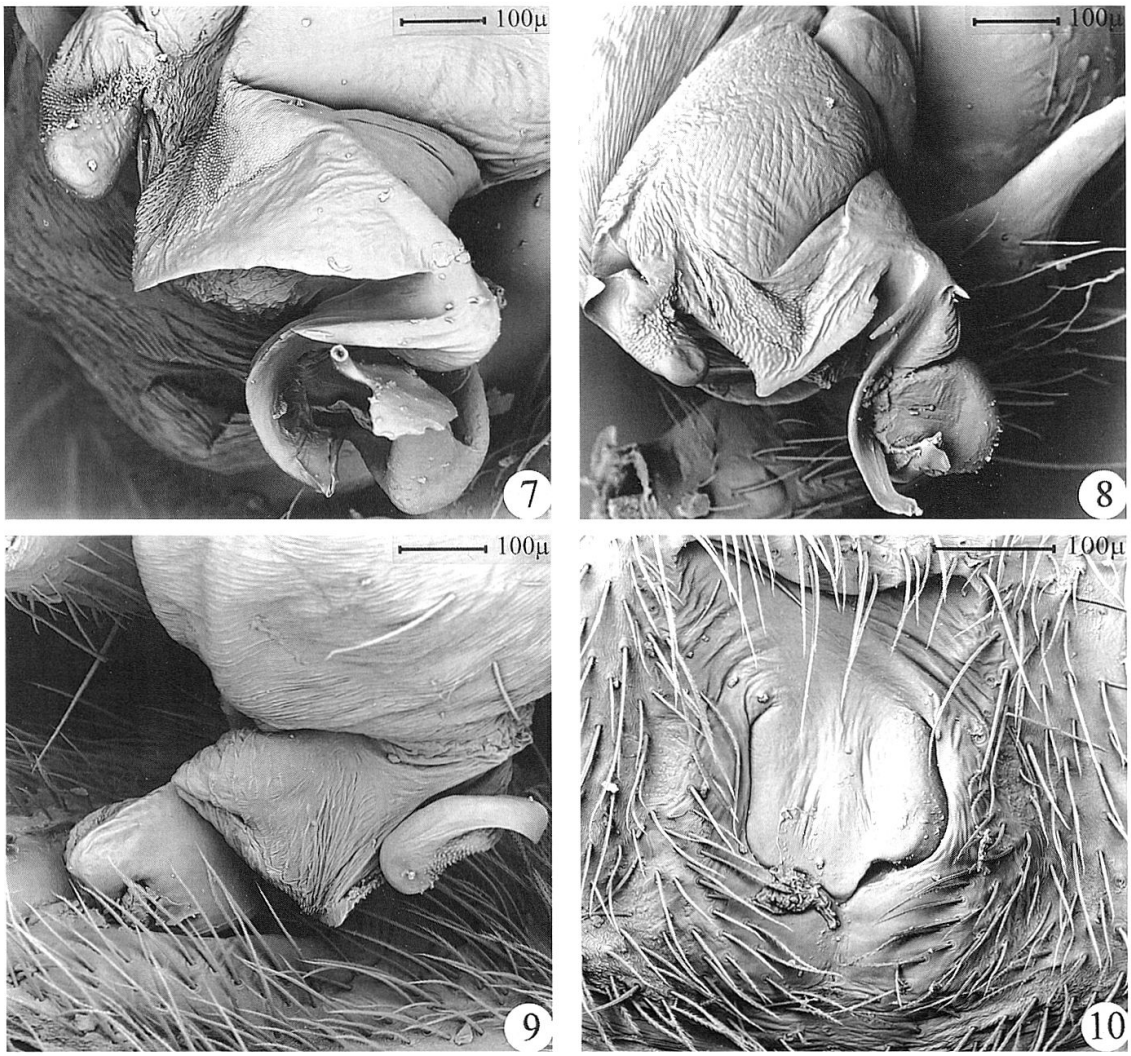


Fig. 7: *Zelotes apricorum*, left male palp *in copula*, apical view (compare with Fig. 5). Figs 8-10: *Zelotes aeneus*, left male palp *in copula*; 8: embolar complex, apical view (compare with Fig. 7); 9: inserted, retrolateral view; 10: epigynum, left male palp extracted.

291; Jézéquel 1962a: Fig. 7) for example, the glandular duct opens to the anterior part of the vulval pouch. *Zelodes erebeus* has a long twisted embolus and the secretion glands are found in an anterior position in the lateral fold; the embolus is probably not inserted posteriorly.

Zelotes aeneus (Simon, 1878)

Two mating pairs were fixed. In Figs 2, 9, we see an inserted left pedipalp. Below the free median apophysis is the retrolateral tip of the terminal apophysis. When inserted, the embolar base is separated from the introduced embolus by a bit of embolar haematodocha protruding through the notch. Fig. 10 shows an epigynum, the corresponding extracted pedipalp is shown in Figs 4 and 8 (apical view). The male is slightly oversized. On the epigynum, we clearly see the right anterior anchoring sclerite, which had been stretched by the left male tibial apophysis, and the posterior opening for the embolus. At the anterior left margin of the lateral epigynal fold (right side on picture), we can see the cuticle, which had been lifted by

the tip of the inserted prolateral prong of the embolar base. The prolateral lobe of the terminal apophysis did leave an almost longitudinal impression on the lateral side of the inserted prong, indicating a locking action. The embolar haematodocha has lain flat on the epigynum like a cushion. Other left pedipalp is seen in retrolateral view (Fig. 2), and the same in contact with the epigynum in posterior view in Fig. 3.

Zelotes apricorum (L. Koch, 1876)

One mating pair was fixed. Fig. 6 gives a posterior view of an inserted left pedipalp, Fig. 7 shows an extracted embolar complex in apical view, and Fig. 5 the same during insertion into the vulva in dorsal view. The embolar base is inserted into the lateral pouch of the epigynal fold, with its projection bent into the posterior bag-like bottom of the pouch. The embolus is inserted into the posterior epigynal fold, with the membranous expansion lying against the side of the median posterior epigynal plate protrusion. At the base of the glandular duct, the embolus tip is pressed on the inseminating pore by the prolateral expansion of the embolar base through the vulval membrane. All vulval tissues is removed in Fig. 7. The same left pedipalp is seen on the epigynum in posterior view in Fig. 6.

Zelotes petrensis **group** (= "*Heterozelotes*" in the sense of Lohmander (1944))

In addition to *Z. petrensis*, *Z. longipes*, and *Z. hermanni* added by Miller (1967), *Z. femellus*, *Z. manius*, *Z. sardus* and *Z. talpinus* also belong to this group.

In the vulva of the species examined, the short glandular duct opens at the entrance of the insertion furrow. The emboli have a membranous flange and a ribbon or flap-like expansion near their apex. Median anchoring sclerites are present on the lateral folds of the epigynum. Male pedipalps of *Z. petrensis*, *Z. femellus*, *Z. manius*, *Z. sardus* and *Z. talpinus* have been studied. In the two species studied *in copula*, the embolar base bears a prolateral apophysis referred to as "mesal apophysis". It is used as an anchoring device to the median epigynal pocket. In *Z. femellus*, *Z. manius* and *Z. talpinus* the mesal apophysis is taking the shape of a broad sclerotized lamina, widely separated from the terminal apophysis (Figs 82-85, 90). All the species of the *Z. petrensis* group have in common a posterior sickle shaped sclerotized lamina on the embolar base. This structure is used as a posterior backing to the embolar haematodocha.

The terminal apophysis is linked by a posterior sclerite to the embolar radix and tegular base (Figs 11-14). The fused embolar base and intercalary sclerite have the appearance of a single sclerite (Figs 18, 78-79, 88). *Zelotes petrensis* is distinguished from the other species examined by an articulated embolar base linking the terminal complex (including the mesal apophysis) to the embolar complex (Fig. 14), resulting in a relatively independent terminal complex.

Zelotes petrensis (C. -L. Koch, 1837)

A single successful mating was observed. On Fig. 19, we see the inserted left male palp in prolateral posterior view. The huge embolar radix is on the left side; near its base is the almost vertical posterior sclerite of the terminal apophysis; the curled median apophysis is further right. Fig. 12 shows the same pedipalp in contact with the epigynum in posterior view; Figs 11 and 20 in female right view; note the embolar radix linked to the terminal complex by the embolar base. The termi-

nal complex is fixed to the median epigynal sclerite; the hook-like mesal apophysis is anchored under the sclerite and the terminal apophysis leans on it for locking pressure. The detached terminal complex is seen in a retrolateral-anterior view in Fig. 13; the intercalary sclerite base connected on the broken tegulum and the posterior sclerite to embolar radix and tegular bases; the doted lines show the broken soft tegular cuticle, a flexed link to the tegulum. The apophyses complex is itself articulated on the intercalary sclerite by a soft cuticle. The embolus was unfortunately destroyed during extraction; we see on Figs 11, 20 the site of embolus insertion with the membranous flange margin protruding from the epigynum. Fig. 14 shows a left bulbus at rest in prolateral-posterior view, displaying the articulate link between terminal complex and embolar complex; note that embolar radix and posterior sclerite of the terminal apophysis are connected to the tegular base.

Zelotes sardus (Canestrini, 1873)

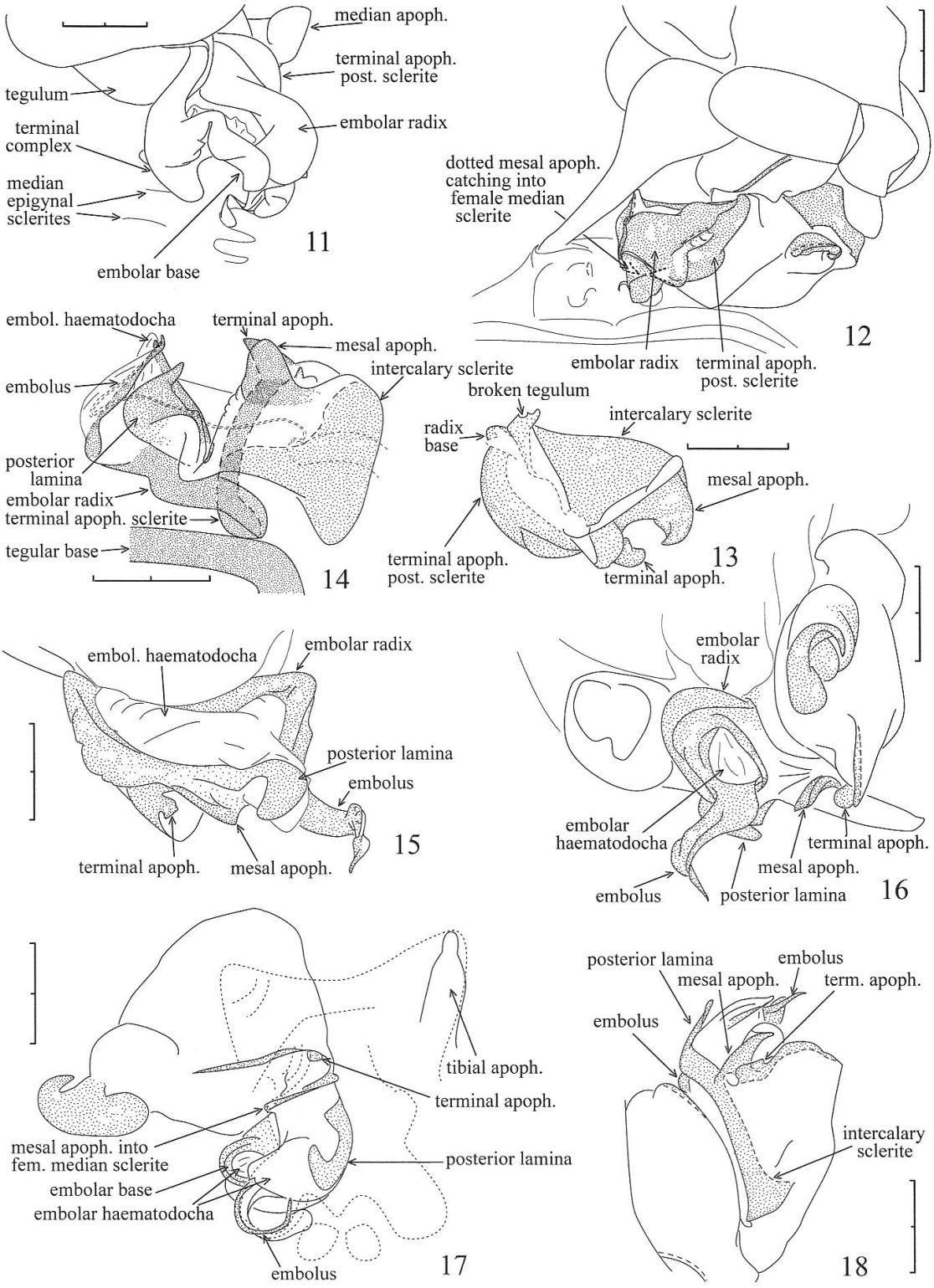
Two mating pairs were fixed. In contrast to the strong terminal apophyses found in *Z. petrensis*, *Z. sardus* has a weak apophysis on the prolateral side of the apical terminal ridge, and the mesal apophysis, equally used for median fixing, is linked ventrally with a membrane to the embolar complex (Figs 15-17, 24); the base of the mesal apophysis is united to the terminal complex. The mesal apophysis anchoring point is visible as a slight oblique impression on the left side of the middle epigynal plate (Fig. 23, right on picture). As a locking device, the terminal ridge depresses the epigynal lateral side by strong pressure. The fixation is weak and extraction occurred before observation. However, the study of epigynum and extracted pedipalp gives an accurate understanding of their relations. The rim of the embolar flange is clearly protruding from the epigynum, as it is in *Z. petrensis*. A second pair of spiders fixed in the intromission phase shows the embolus passing on the backside of the median apophysis (Fig. 25). The use of the median apophysis as a temporary functional conductor is backed by an observations on *Z. caucasius*.

Zelotes gracilis group (= "*Microzelotes* " in the sense of Miller (1967))

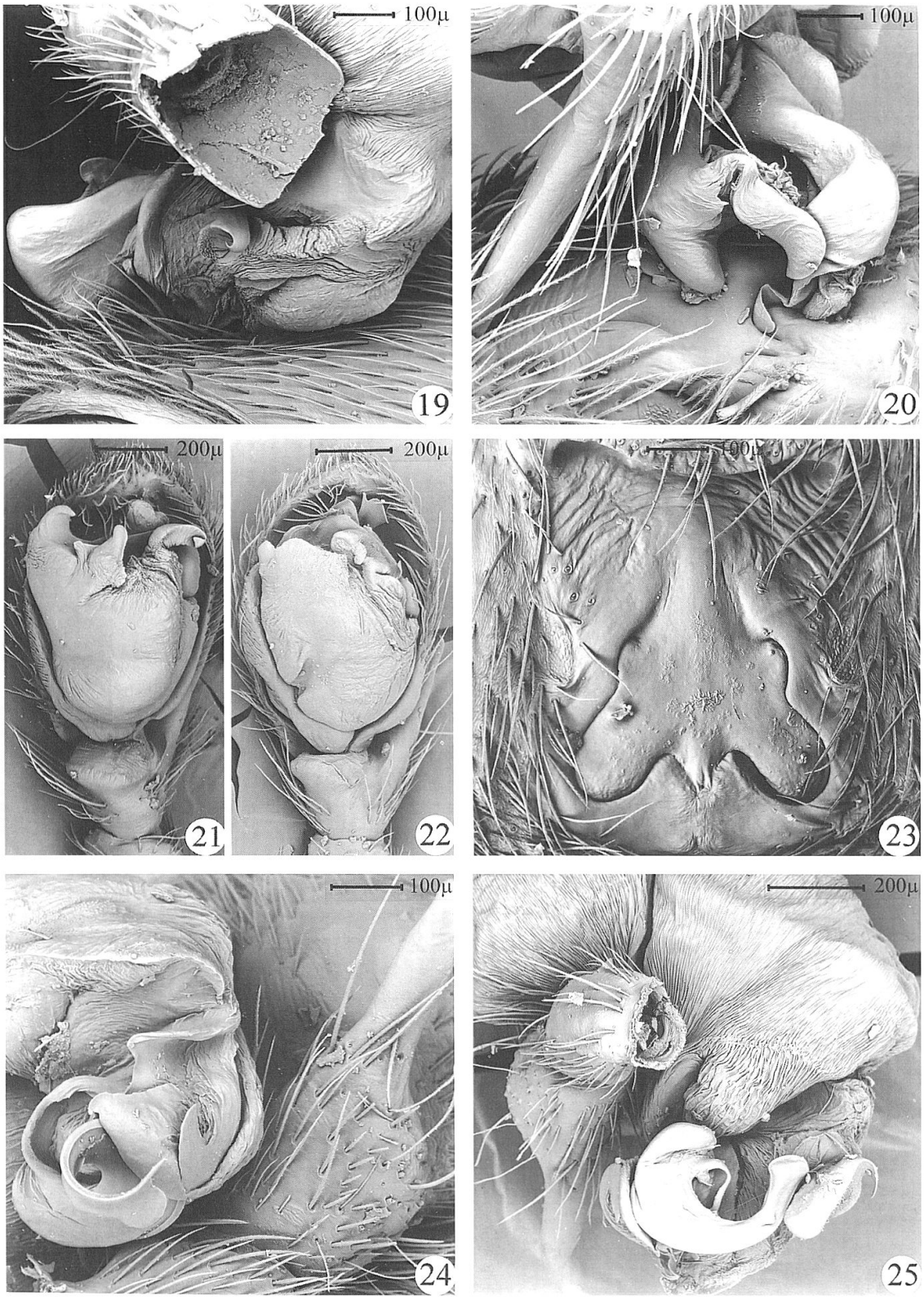
In *Z. caucasius* and *Z. solstitialis* the two species examined, an embolar radix is present. The free embolar base directly articulated to the tegulum, the sperm duct directly connected to the embolar base, the absence of embolar haematodocha and terminal apophysis would exclude this group from the genus *Zelotes*. As I have not been able to study the other species of the *gracilis* group, its status is left unchanged.

Zelotes caucasius (L. Koch, 1866)

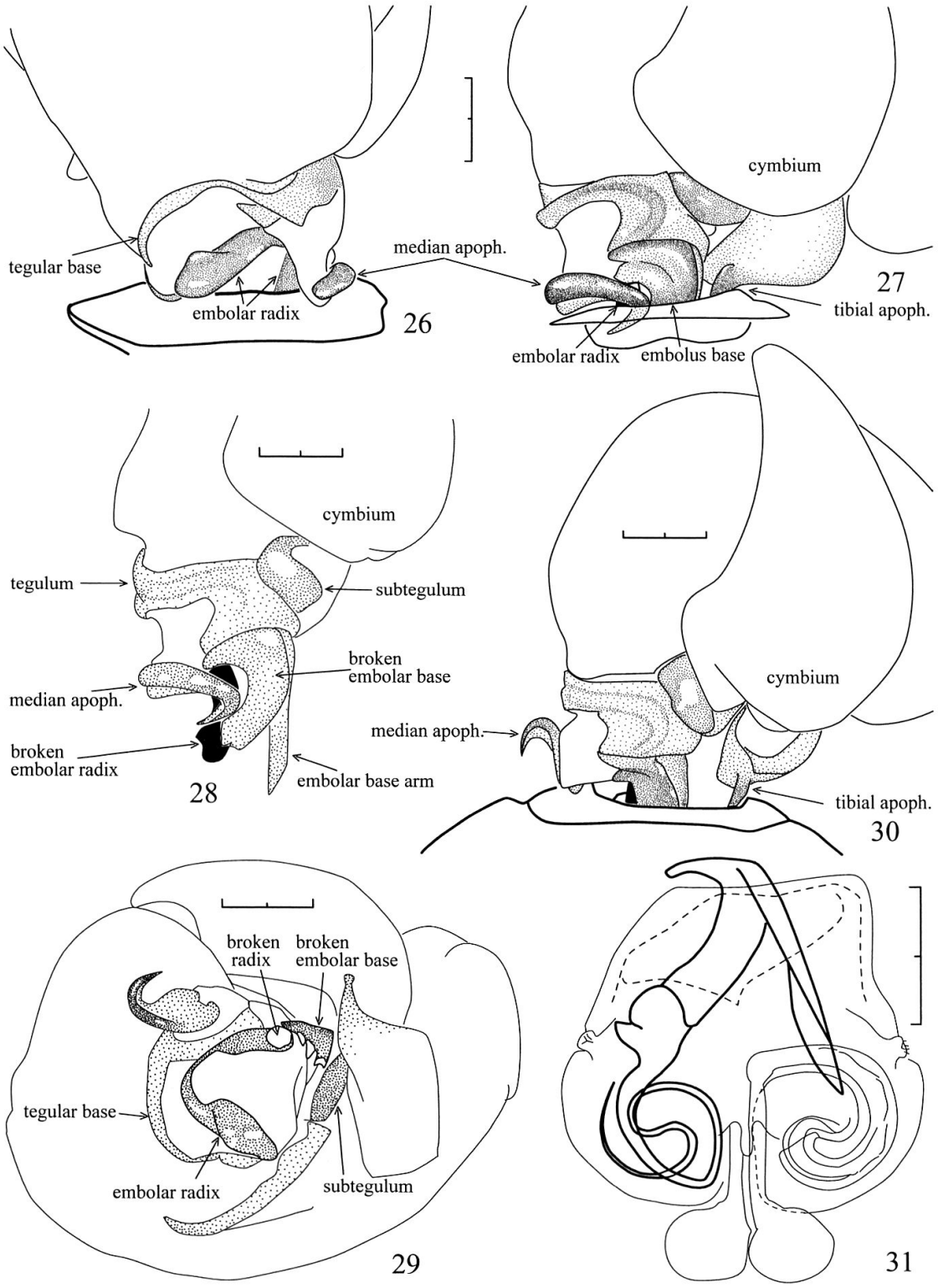
Tree mating pairs were fixed. Fig. 31 shows the embolar base (embolar radix omitted) inserted into the epigynal fold, the long embolus in the coiled vulval duct and the prolateral branch is diverging to the opposite side of the insertion. Coupled to a long embolus, the glandular secretion ducts are situated at the entrance of the vulva. In one mating of a disproportionate pair (Figs 26-28), the big male did achieve intromission successfully; in this case, the median apophysis remained hooked into the anterolateral epigynal margin, the opposite corner being occupied by the tibial apophysis. The extreme disparity of size between male and female led to a faulty penetration of the embolus, which, after one turn, broke the female duct and came out of the epigynum; I only understood the anomaly while studying the cleared



Figs 11-14: *Zelotes petrensis*; 11-13; left male palp *in copula*; 11: retrolateral view; 12: posterior view; 13: terminal apophyses complex, antero-retrolateral view; 14: embolar complex of a resting left male palp, dorso-mesal view. Figs 15-18: *Zelotes sardus*; 15-17: Left male palp *in copula*; 15: extracted, retrolateral view; 16: id., prolateral view; 17: id., inserted in the vulva, dorsal view; 18: resting left male palp, prolateral view. Scale lines: 0.2 mm.



Figs 19-21: *Zelotes petrensis*; 19-20: left male palp *in copula*; 19: prolateral-posterior view; 20: retrolateral view (compare with Fig. 11); 21: resting left male palp, ventral view. Figs 22-25: *Zelotes sardus*; 22: resting left male palp, ventral view; 23: epigynum *in copula*; 24: left male palp in copula; apical view (compare with Fig. 15); 25: left male palp in intromission phase, apical view.



Figs 26-31: *Zelotes caucasius*, left male palp *in copula*; 26-28: male 1; 26: Prolateral view; 27: anterior view; 28: extracted, anterior view; 29: male 2, anterior view; 30: male 3 extracted, apical view; 31: vulva with inserted embolus, dorsal view. Scale lines: 0.2 mm.

vulva. In a previous insertion with the other pedipalp, the protruding embolus tip was visible in the video recording. The Figs 29-30 show a normal mating with a median apophysis left free. In Fig. 29, we see the apical view of an extracted left male pedipalp with broken embolar radix and embolar base.

Zelotes fuscorufus (Simon 1878) (*Z. tenuis* group)

In the *Z. tenuis* group the embolus is fused to the embolar base. One successful mating was achieved. The Figs 32-33 show the inserted left embolus in prolateral and anterior view. There is a simple penetration of the embolar complex into the lateral fold of the epigynum. In Fig. 34 the broken embolar base with the embolus is seen in the lateral epigynal pouch, with the embolus tip at the entrance of the sclerotized spermathecal duct where the glandular duct opens. No further observation was possible as the male pedipalp was destroyed during separation.

Drassyllus Chamberlin, 1922

In the genus *Drassyllus* the male bulbus have bifid terminal apophyses extended ventrally to the tegulum and fused to the embolar base. Posterior margin of terminal apophysis linked to the tegular haematodocha. Epigynum with two symmetric plates separated by a T-shaped septum.

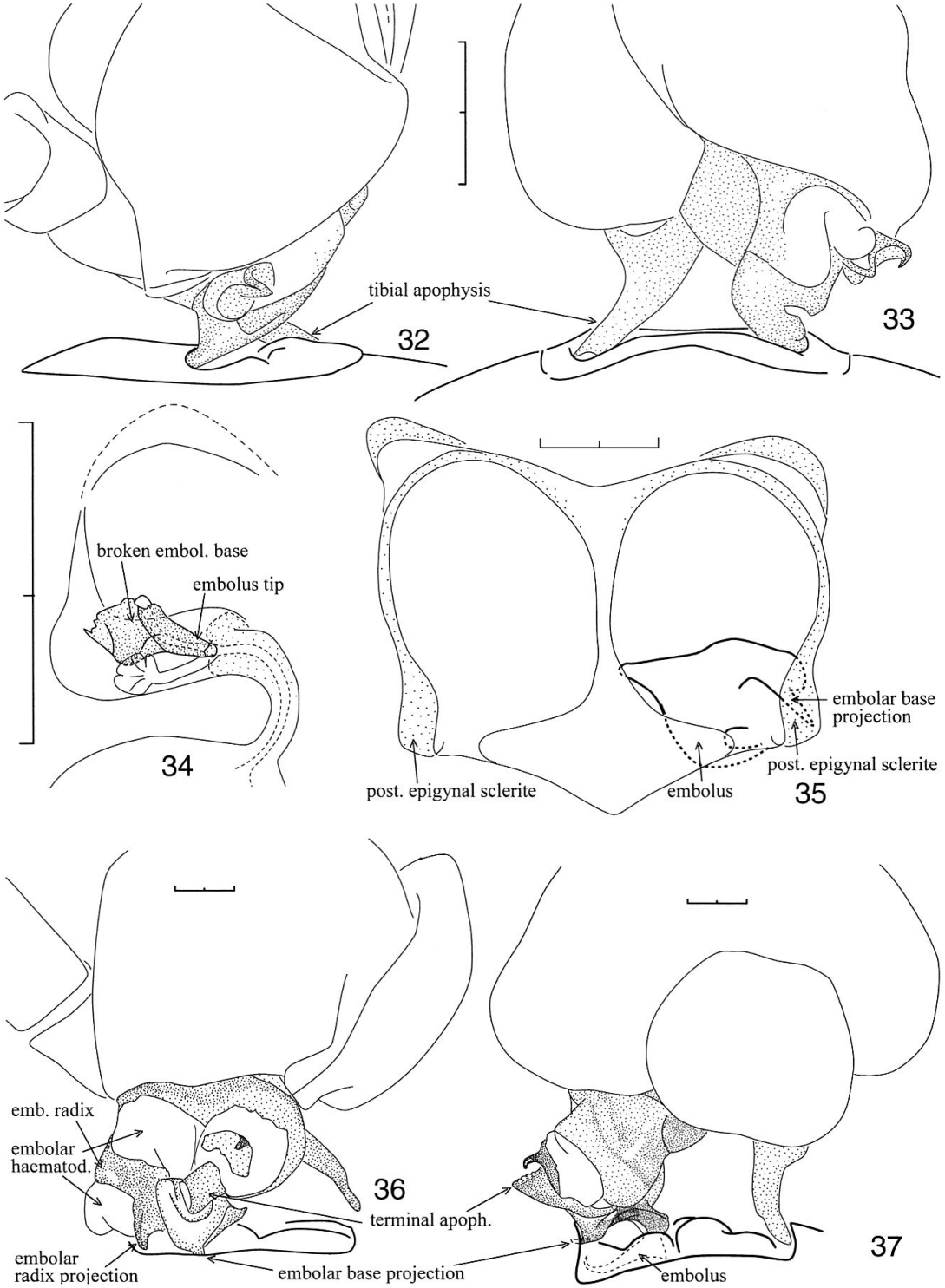
Drassyllus praeficus (C. L. Koch, 1866)

The terminal apophysis fused to the embolar base, is extended to the articulation at the base of the tegulum, relatively close to the embolar radix base (Figs 38, 40). *In copula* a large embolar haematodocha between embolar radix and posterior base of terminal apophysis flexes the sclerite along the tegulum to about 40 ° (Fig. 38). The extended terminal apophysis and the large embolar radix are clearly visible in the resting pedipalp (Fig. 40). The terminal apophysis is devoid of a posterior sclerite. *In copula* the embolar haematodocha pushes the junction between embolar base and embolus to the prolateral side with the embolar radix base as axis (Figs 38-39). A second articulation to the embolar complex is the ventral margin of the terminal apophysis base flexed along the tegulum. The embolar base, fused to the terminal apophysis, is bent 180° at the level of the terminal apophysis. Figs 36-37 show the inserted left male pedipalp in retrolateral (36) and anterior view (37, embolus doted). Fig. 38 shows the extracted left palp in apical view; the embolar complex composed of the embolus, the tips of embolar radix and the apex of embolar base are forming an arched triangular plate. The embolus is inserted under the front margin of the posterior lateral extension of the T-shaped mid-piece (Fig. 35). The tip of the embolar base is lying on the epigynum, hooked under the rim of the mid-piece, and its projection is inserted under the epigynal posterior anchoring sclerite (embolar radix projection not shown). The terminal apophysis may have a temporary function during insertion, but apparently none during copulation. In the vulva, the glandular duct opens near to where the tip of the embolus rests during *copula*.

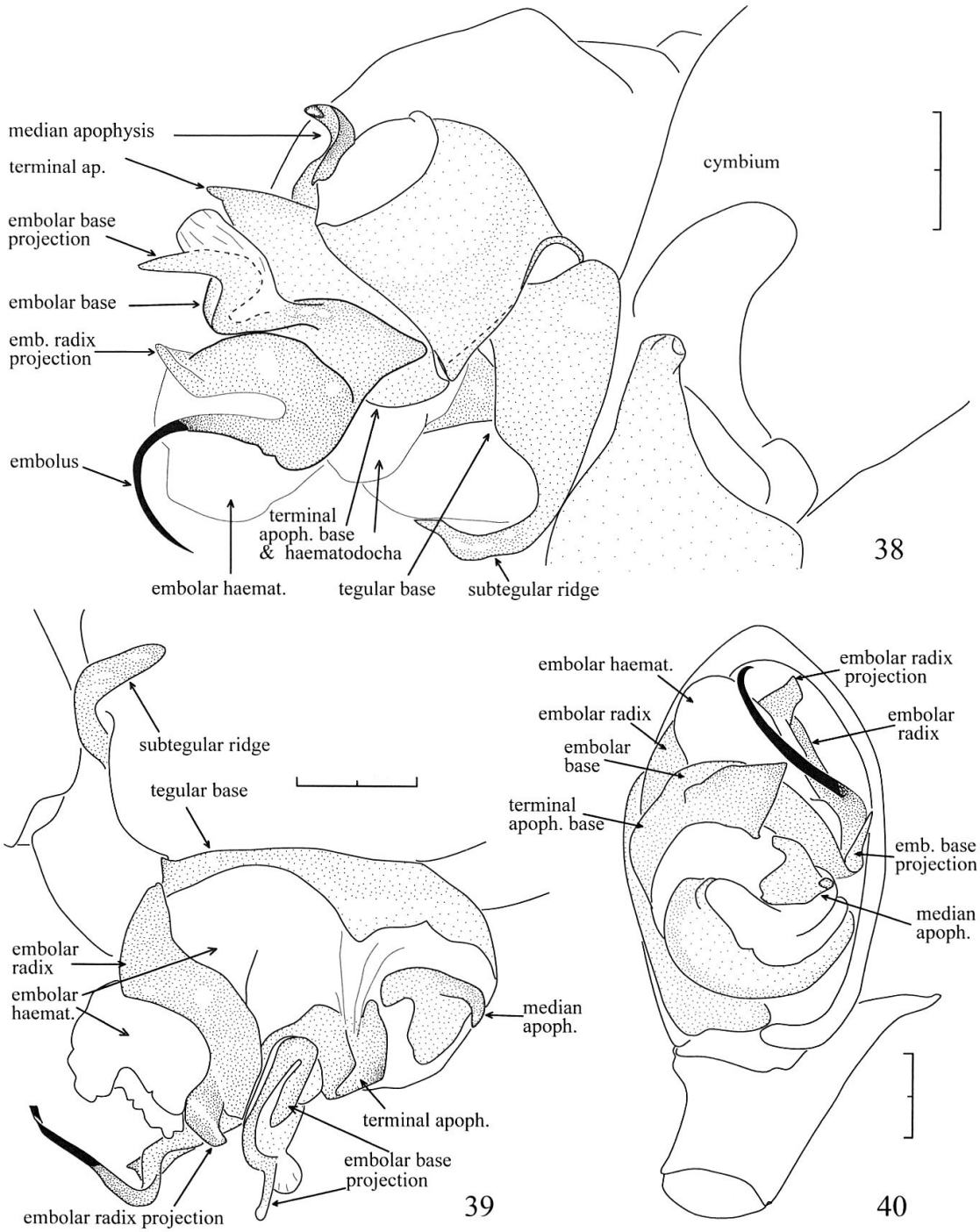
Trachyzelotes pedestris (C. L. Koch, 1837)

Two mating pairs were fixed. Fig. 41 shows the left male pedipalp inserted in retrolateral view. During pedipalp extraction, the mesal apophysis, inserted in the middle depression of the epigynum ripped the cuticle (Fig. 43). On the right side of the same figure, we see the epigynal fold opened by the embolus and some dried

liquid. On the left side the rim of the anterior margin slightly broken by the tibial apophysis. Fig. 44 shows the extracted male left pedipalp in apical view, with the mesal and median apophyses, and with the embolus.



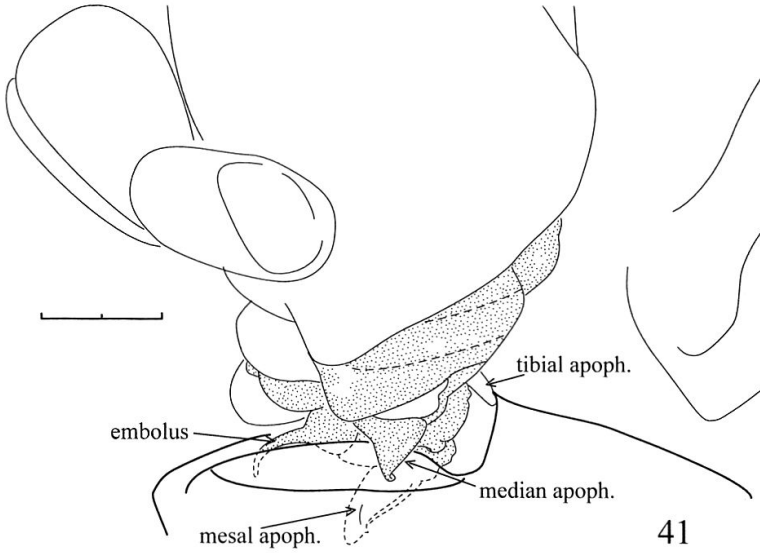
Figs 32-34: *Zelotes fuscorufus*, left male palp *in copula*; 32: prolateral view; 33: anterior view; 34: vulva with embolus tip, dorsal view. Figs 35-37. *Drassyllus praeficus*, left male palp *in copula*; 35: epigynum and embolar complex, ventral view; 36: male palp inserted, retrolateral view; 37: id., anterior view. Scale lines: 0.2 mm.



Figs 38-40: *Drassyllus praeficus*; 38-39: left male palp *in copula*; 38: apical view; 39: retrolateral view; 40: resting male palp, ventral view. Scale lines: 0.2 mm.

Trachyzelotes lyonneti (Audouin, 1827)

One mating pair was fixed. Unfortunately, the pedipalp was lost during extraction and only the mated epigynum remained (Fig. 46). The impression on the left side of the epigynum suggests the insertion of a large part of the embolar base; the modification of the embolar complex by the haematodocha remains unknown, but the posterior rim of the pit is largely broken.



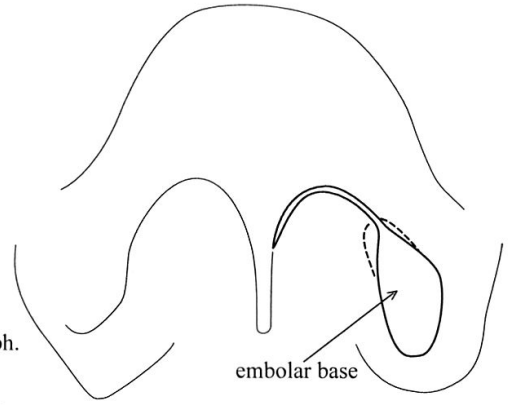


Fig. 41: *Trachyzelotes pedestris*, left male palp *in copula*, retrolateral view. Fig. 42: *Trachyzelotes lyonneti*, *in copula*; epigynum with indication of inserted embolar complex. Scale lines: 0.2 mm.

SYSTEMATIC AND FAUNISTIC DATA

Genus Zelotes Gistel, 1848

Remarks: Except for the material from the Museum National d'Histoire Naturelle, Paris (MNHN) specially mentioned, the material collected by myself is placed in my own collection.

The typical leg spination according to Platnick & Shadab (1983) is: femora: I, II d1-1-0, p0-0-1; III, IV d1-1-0, p0-1-1, r0-1-1; patella III r0-1-0; tibiae: III p1-1-1, v2-2-2, r0-1-1; IV p1-1-1, v2-2-2, r1-1-1; metatarsi: I, II v2-0-0; III p1-2-2, v2-2-1, r1-1-2; IV p1-2-2, v2-2-0, r1-2-2. Only differences from this pattern are given in the text. AME, ALE, PME, PLE and MOQ refer to anterior median, anterior lateral, posterior median, posterior lateral eyes and median ocular quadrangle (eyes included).

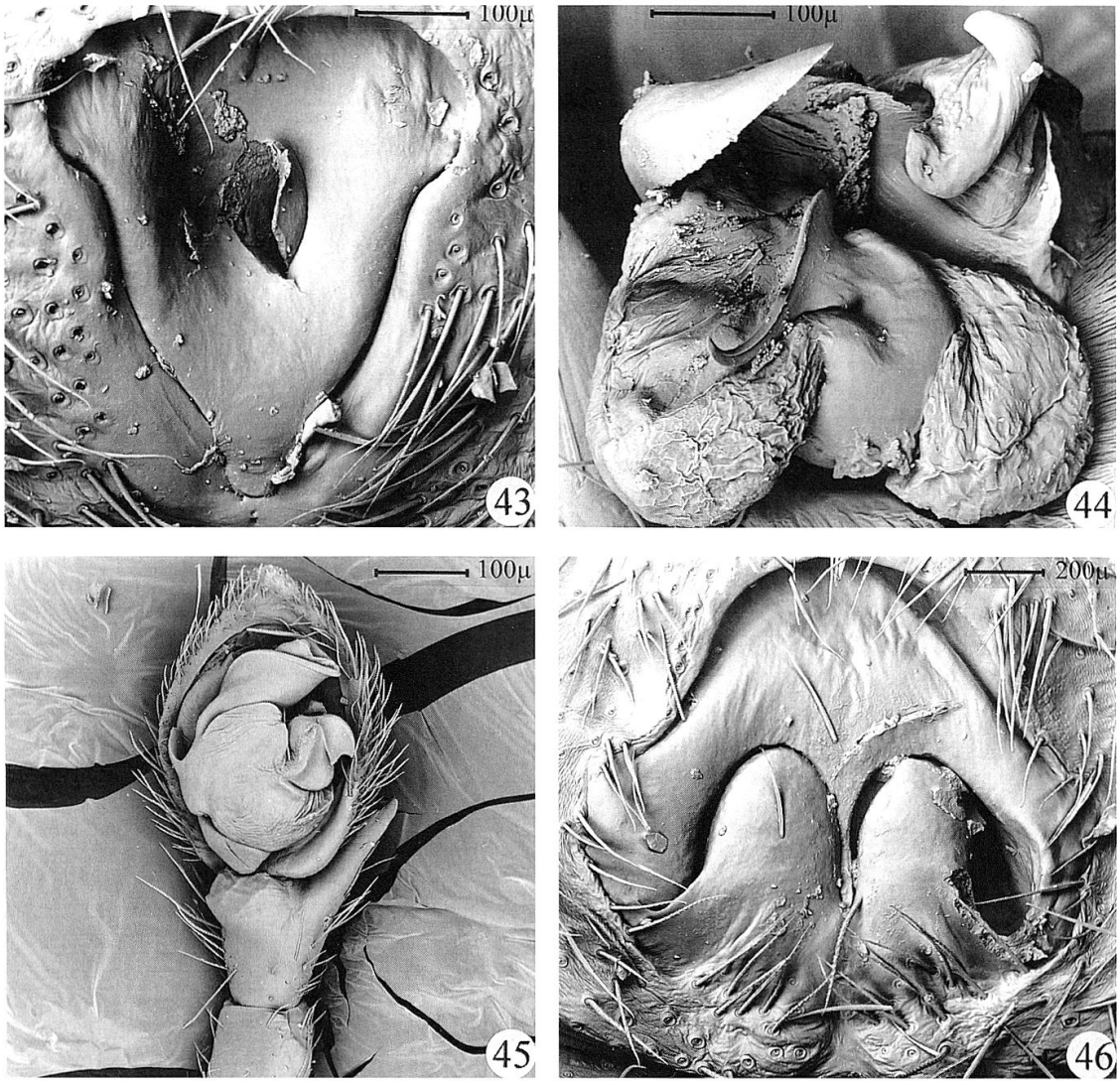
Z. tenuis group

Z. tenuis (L. Koch), *Z. fulvaster* (Simon), *Z. fuscorufus* (Simon) and *Z. ruscinensis* (Simon) are united by the shape of the male embolar complex (Figs 47-48 and 53-54); the females by the epigynal folds interrupted in the rear centre and the arched shape of the median ducts (Figs 49-52).

Zelotes fuscorufus (Simon, 1878) (Figs 32-34, 51-54)

Prosthesima fusco-rufa Simon, 1878: 95, pl. 14, f. 28 (D♂ ♀)
Z. fuscorufus:- Jézéquel, 1962b: 603, f. 24 (♀)
Z. fuscotestaceus:- Marinaro, 1967: 697, f. 17-18 (D♂, misidentification)

Material examined: MNHN PARIS: tube AR 1745 b. 568, without station, 2 ♂ renamed *Z. fuscotestaceus* by Di Franco (7/88).
FRANCE: CORSICA: Sud Corse: Chiavari /Ajaccio, 31/5/71, 1 ♂; Porto Pollo /Olmeto, 16/6/99, 1 ♂, 1 ♀ (last moult ♀ 27/6); pont d'Acorane /Sartène, 19/6/99, 1 ♀; ITALY: SARDINIA: Sassari: Platamona /Porto Torres (dry litter, barks), 24/5/99, 4 ♂, 6 ♀ (last moult ♀ 5-30/6); Ozieri, 28/5/99, 2 ♂; Stagno di Calich /Alghero, 29/5/99, 1 ♀. Oristano: Iz Arénas /Narbolia (dry litter on sand), 31/5/99, 1 ♂, 6 ♀ (last moult ♀ 9/6-11/7).



Figs 43-44: *Trachyzelotes pedestris*, *in copula*; 43: epigynum; 44: left male palp, apical view. Figs 45-46: *Trachyzelotes lyonneti*; 45: resting left male palp; 46: epigynum *in copula*, embolus complex extracted (compare with Fig. 42).

Remarks: Zelodes fuscorufus was described on males and females (Simon 1878) with drawing of the male pedipalp (Fig. 28) clearly recognizable by the tibial apophysis and the epigyna (Fig. 29) with the typical clearly transverse epigynal plate. I have not been able to see the type specimen of *Z. fuscotestaceus*; Jézéquel's drawing of the vulva (1962b: Fig. 30, presumably holotype: "tube 1897, Plouharnel, Morbihan") shows a vulva of *Z. tenuis* and thus exclude the possibility of being conspecific with *Z. fuscorufus*.

Diagnosis: The male of *Z. fuscorufus* is easily distinguished from males of other *tenuis* group species by its bifid retrolateral tibial apophysis and by its embolar base more vertical; the female is distinguished by its transverse epigynal plate and very large spermathecae. Three teeth are present on the anterior cheliceral margin.

Redescription: Male: Total length 5.6 ± 1.6. Prosoma 2.6 ± 0.7 long, 1.9 ± 0.6 wide. Eye sizes and interdistances: AME 0.1, ALE 0.16, PME 0.13, PLE 0.12;

AME-AME 0.08, AME-ALE 0.02, PME-PME 0.04, PME-PLE 0.05, ALE-PLE 0.07. MOQ length 0.36, front width 0.57, back width 0.64. Oblique embolar base extending into a vertical embolus (Figs 53-54). Retrolateral tibial apophysis shorter than tibia is wide to its bifid tip. Patella dorsally longer than tibia. Scutum covering 1/4 of the opisthosoma. Female: Total length 5.7. Prosoma 2.5 long, 1.8 wide. Eye sizes and interdistances: AME 0.08, ALE 0.11, PME 0.11, PLE 0.08; AME-AME 0.07, AME-ALE 0.01, PME-PME 0.03, PME-PLE 0.04, ALE-PLE 0.04. MOQ length 0.25, front width 0.41, back width 0.5. Epigynal plate wider than long (Fig. 51); its posterior half membranous and its anterior half slightly sclerotized. Short lateral folds interrupted in the rear centre; insertion pouches situated posteriorly. Vulva (Fig. 52) with sclerotized median ducts and very large spermathecae.

Prosoma tawny, with sparse short hairs and a median line of black bristle; clypeus narrow. Opisthosoma dorsally blackish, covered with black bristles, ventrally tawny grey, with black hairs. Legs tawny, slightly darkened except on femora; tarsi I, II scopulate; metatarsi I, II scopulate apical 2/3. Posterior eyes row slightly procurved in dorsal view, occupying 47% of prosoma width at that point.
Sympatric with *Z. tenuis*, *Z. fuscorufus* prefer litter on dry sandy soil, leaving humid litter biotope to the competitor. In absence of competition, *Z. tenuis* is to be found equally in dry litter

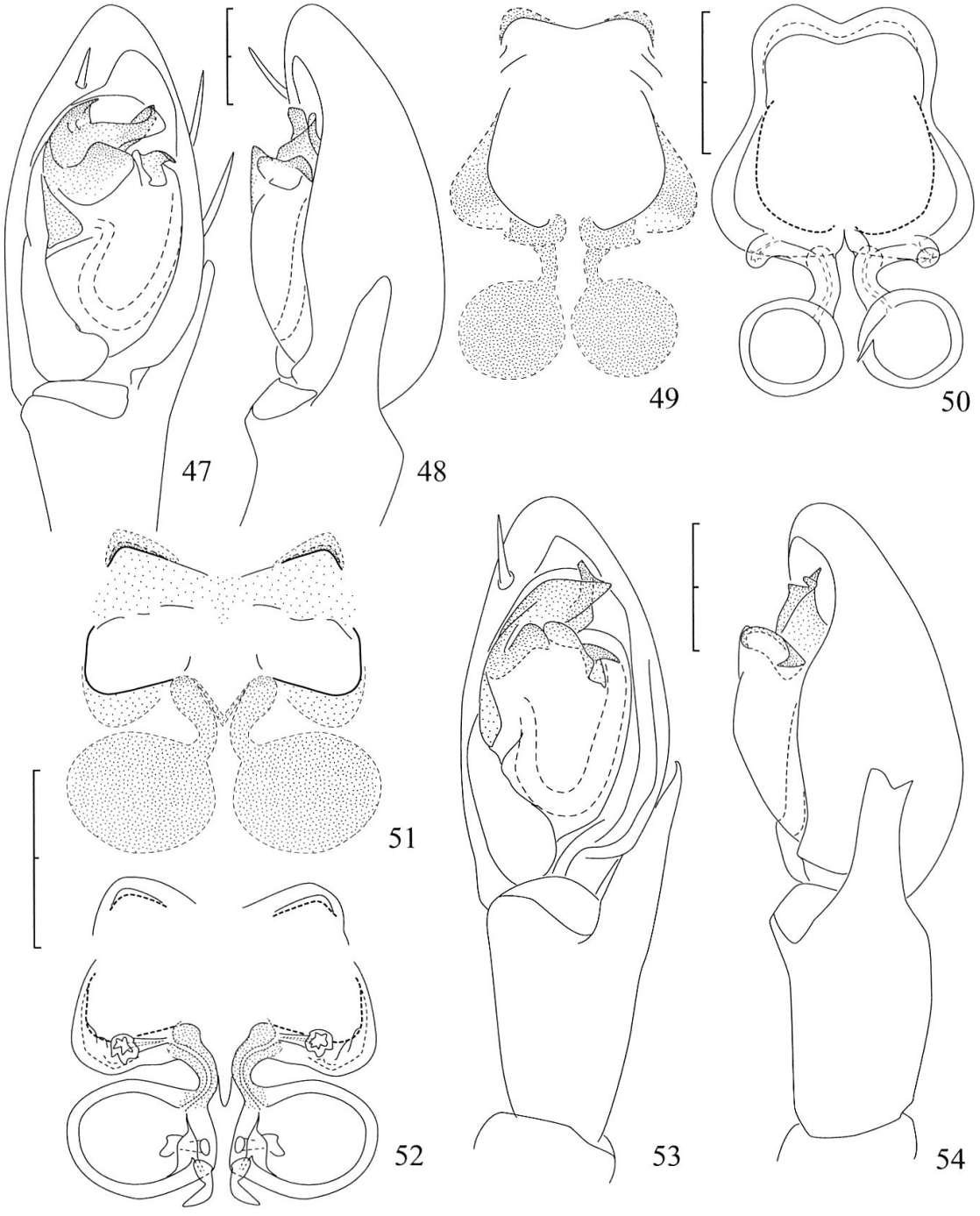
Zelotes ruscinensis Simon (1914) (Figs 47-50)

Z. ruscinensis Simon, 1914: 157, 169, 219, f. 295, 346 (D♂ ♀)
Z. circumspectus:- Denis, 1935: 117, f. 2 (♀, misidentification)
Z. adolescentulus Denis, 1952: 118, f. 9-10 (D♂). **Syn. nov.**
Z. lugens Denis 1941: 258, f. 1-2 (♀). **Syn. nov.**
Z. ruscinensis:- Jézéquel, 1962b: 604, f. 28 (♀)
Z. massiliensis Soyer, 1967: 278, f. 8-13 (D♂ ♀). **Syn. nov.**
Z. lugens:- Di Franco, 1997: 258, f. 1-2 (♀)

Material examined: MNHN Paris, a slide PM 59, type coll. Simon, vulva.
FRANCE: CORSICA: Sud Corse: Porto Pollo /Olmeto, 16/6/99, 1 ♀. ITALY: SARDINIA: Sassari: Stagno di Calich /Alghero, 29/5/99, 2 ♂ (last moult 12-16/7). SPAIN: LEVANTE/ MURCIA: Murcia: Archena, 38°07'N 01°17'W, 17/5/02, 1 ♂, 1 ♀ (last moult ♂ 11/7, ♀ 8/8). N. CASTILLA / LA MANCHA: Ciudad Real: Fuencaliente, 3/8/69, 1 ♀. EXTRAMADURA: Badajoz: Rio Sillo (Higuera la Real), 38°06'N 06°41'W, 9/6/02, 2 ♂ (last moult 12-22/7). ANDALUSIA: Sevilla: Rio Viar /Castilblanco, 37°43'N 05°53'W, 2/6/02, 1 ♂, 2 ♀ (last moult ♂ 3/8, ♀ 4-13/8); Pantano del Pintado /Cazalla de la Sierra, 2/7/69, 2 ♂; Coripe (rio Guadalete), 18/7/69, 1 ♀. Huelva: Santa Olalla (rio Cala), 37°55'N 06°11'W, 4/7/69, 9 ♂.

Remarks: The slide MNHN PM 59 (Fig. 50) seems to be the only original type material for this species, used for the drawing of Jézéquel (1962b: Fig. 28). The drawing in the original description of *Z. lugens* (Denis 1935: Fig. 2 sub *Z. circumspectus*) clearly shows a *Z. ruscinensis* female with the long well-separated median ducts and with a narrow anterior margin. The illustration of the epigynal plate of "*Z. ruscinensis*", in the same publication (Denis 1935: Fig. 1) appears to refer to a species in the *Z. subterraneus* group. Soyers's (1967: Fig.11) rudimentary drawing of the male of *Z. massiliensis*, with its strong hooked prolateral embolar base apophysis clearly shows a male of *Z. ruscinensis* and the illustration of the vulva (Fig. 13) corroborates this.

Diagnosis: The male of *Z. ruscinensis* is easily distinguishable from those of other species of the tenuis group by its large prolateral hook on the embolar base, and the female by its wide insertion pouches, its narrow anterior epigynal margin and its widely separated median ducts.



Figs 47-50: *Zelotes ruscinensis*; 47: left male palp, ventral view; 48: id., retrolateral view; 49: epigynum; 50: vulva (type specimen MNHN), dorsal view. Figs 51-54: *Zelotes fuscorufus*; 51: epigynum; 52: vulva, dorsal view. 53: left male palp, ventral view; 54: id., retrolateral view. Bold lines are epigynal folds. Scale lines: 0.2 mm.

Redescription: Male: Total length 7.2 ± 1.2. Prosoma 3.1 ± 0.22 long, 2.2 ± 0.4 wide. Eye sizes and interdistances: AME 0.08, ALE 011, PME 0.12, PLE 0.1; AME-AME 0.07, AME-ALE 0.01, PME-PME 0.02, PME-PLE 0.05, ALE-PLE 0.07. MOQ length 0.31, front width 0.42, back width 0.51. Embolus short (Figs 47-48); embolar base bearing a strong prolateral hook directed retrolaterad. Retrolateral tibial apophysis shorter than tibia; patella dorsally longer than tibia. Scutum short.

Female: Total length 5.7. Prosoma 2.8 long, 2.1 wide. Eye sizes and interdistances: AME 0.07, ALE 0.14, PME 0.13, PLE 0.1; AME-AME 0.07, AME-ALE 0.01, PME-PME 0.02, PME-PLE 0.05, ALE-PLE 0.05. MOQ length 0.3, front width 0.47, back width 0.53. Epigynum (Fig. 49) with rounded lateral folds interrupted in the rear centre; their pouches widened. Anterior margin much narrower than the epigynal plate length; both anchoring pockets sometimes fused to form a single bow. Vulva (Fig. 50, Type specimen) showing widely separated sclerotized median ducts of variable length. Secretion glands situated at the posterior margin of the pouches.

Prosoma tawny with very short sparse hairs and some posterior bristles. Clypeus about AME radius. Opisthosoma dorsally blackish, covered with black bristles, ventrally whitish, with black hairs. Legs tawny; tarsi I, II scopulate; metatarsi I, II scopulate in apical part. Posterior eyes row slightly procurved in dorsal view, occupying 43% of prosoma width at that point.

Zelotes subterraneus group

Zelotes aeneus (Simon), *Z. apricorum* (L. Koch), *Z. cyanescens* Simon, *Z. egregius* Simon and *Z. gallicus* Simon are treated here.

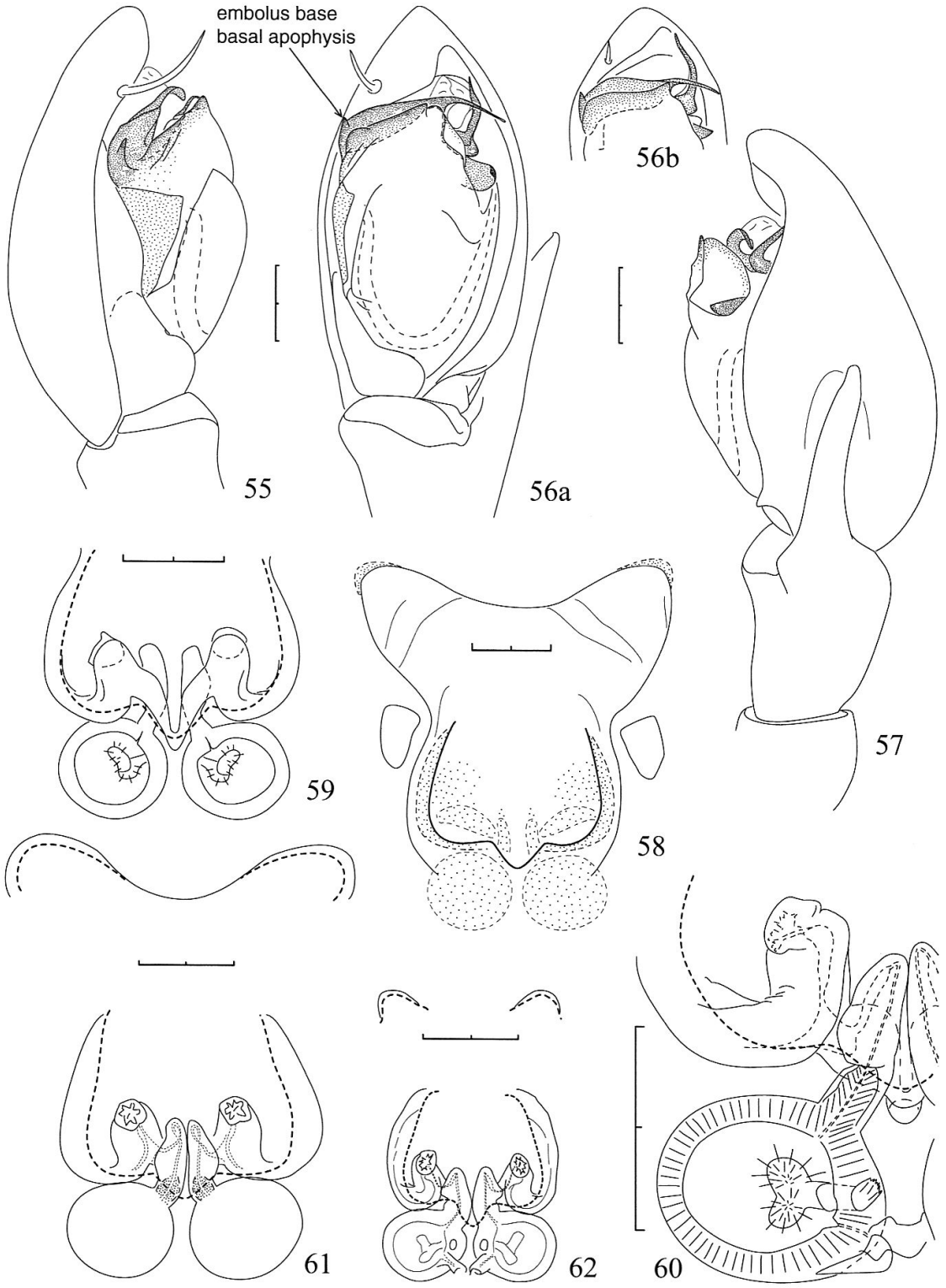
Zelotes egregius Simon, 1914 (Figs 55-61)

Z. egregius Simon, 1914: 174, f. 316 (D♂, not ♀, fig. 361, = *Z. latreillei*)
Z. reconditus Simon, 1914: 179, 215, f. 379 (D♀) (examined). **Syn. nov.**
Z. reconditus:- Jézéquel, 1962b: 598, f. 9 (♀)

Material examined: MNHN Paris: tube AR 925, syntypes, 5 ♂ labelled "*Z. egregius*", misidentified as *Z. aeneus* by W. Job (1968), Canigou, 1 ♂ here designated **lectotype** in order to preserve stability of nomenclature; two microscope slides *Z. reconditus* without locality data: PM 29, "tube 21765", here designated **lectotype** of *Z. reconditus* (Fig. 61) in order to preserve stability of nomenclature, and PM 28, labelled "*Z. reconditus*", "tube 24888", a vulva in bad condition but recognisable; one female *Z. reconditus* void of a vulva from Pic du Midi de Bigorre (Coll. Dresco).
FRANCE: Pyrénées Orientales: Banyuls sur Mer, 42°28'N 03°07'E, 27/6/01, 1 ♂ (last moult 2/11). ANDORRA: O. de St Julià de Loria (1400m.), 42°27'N 01°28'E, 8/7/01, 1 ♂, 4 ♀ (last moult 3 ♀ 11/7-27/8); O. de St Julià de Loria (1400m.), 42°27'N 01°28'E, 29/6/02, 1 ♀ (last moult 10/8).

Remarks: I was able to examine some material of *Z. reconditus* ♀ from Simon's collection in the MNHN Paris. At first sight I considered Simon's material as oversized specimens of *Z. aeneus* as their vulvae do not show any differences in structure with those of *Z. aeneus*. The study of a Pyrenean species of large size and very similar to *Z. aeneus*, but its male easily distinguishable by embolus shape, led to a further examination of *Z. reconditus*. The specimens from Andorra are of large size and the only male from Banyuls is smaller. I give the measures of both males. Subsequent examination of the supposed *Z. aeneus* in tube MNHN AR 925 showed that Job (1969: 377) erroneously attributed the males of *Z. egregius* to *Z. aeneus*. He placed these specimens in *Z. aeneus* in spite of the fact that their emboli lack the membranous flaps seen in his drawings of *Z. aeneus* (Job 1969: Figs 1, 3). These males syntypes of *Z. egregius* are conspecific with *Z. reconditus* and therefore both names (simultaneously introduced in Simon (1914)) are synonyms. The excellent condition of the syntypes of *Z. egregius* leads me to synonymise *Z. reconditus* with *Z. egregius*.

Diagnosis: Spiders of large size; embolus narrow, sinuous without retrolateral membranous flap. The structure of the vulva (Figs 59-61) differs from that of *Z. aeneus* (Fig. 62) by the clearly delimited sclerotized base of the median duct.



Figs 55-61: *Zelotes egregius*; 55-57: left male palp; 55: prolateral view; 56a: ventral view; 56b: id., variant; 57: retrolateral view; 58: epigynum; 59: vulva, ventral view; 60: id., other female, dorsal view; 61: vulva (lectotype of *Z. reconditus*, MNHN, slide PM 29), dorsal view. Fig. 62: *Zelotes aeneus*, vulva, dorsal view. Bold lines are epigynal folds. Scale lines: 0.2 mm.

Redescription: Male: Total length 8.0/6.1. Prosoma 3.7/2.5 long, 3.13/1.95 wide. Eye sizes and interdistances: AME 0.07/0.05, ALE 0.13/0.09, PME 0.11/0.08, PLE 0.1/0.08; AME-AME 0.1/0.07, AME-ALE 0.03/0.02, PME-PME 0.04/0.06, PME-PLE 0.05/0.06, ALE-PLE 0.01/0.06. MOQ length 0.3/0.25, front width 0.5/0.35, back width 0.6/0.4. Embolus narrow and sinuous, void of any prolateral membranous flap. Embolar base bearing a conical prolateral apophysis, its projection elongated to the margin of the cymbium (Figs 55-57). Slender retrolateral tibial apophysis bent slightly backward. Pedipalpal patella slightly longer than tibia. Scutum short. Leg spination: metatarsi I v0-0-0. Large specimen with an additional spine on femora II p0-1-1 and tibiae III r1-1-1.

Female: Total length 9.5. Prosoma 3.9 long, 3.1 wide. Eye sizes and interdistances: AME 0.08, ALE 0.14, PME 0.13, PLE 0.13; AME-AME 0.11, AME-ALE 0.3, PME-PME 0.07, PME-PLE 0.06, ALE-PLE 0.01. MOQ length 0.36, front width 0.57, back width 0.68. Epigynum (Fig. 58) similar to that of *Z. aeneus*, with a posteriorly situated epigynal fold, differing by its larger membranous surface extending to the anterior margin; anterior anchoring pockets wide apart. Vulva with a clearly delimited sclerotized base of the median ducts.

Prosoma dark brown with numerous and strong black bristles; legs dark brown; opisthosoma black covered with black bristles. Tarsi and metatarsi I, II densely scopulate. Posterior eyes row slightly procurved in dorsal view, occupying 40% of prosoma width at that point.

Zelotes aeneus (Simon, 1878) (Fig. 62)

Prosthesima aenea Simon, 1878: 79, pl. 14, f. 18 (D♂ ♀)
Prosthesima sarda:- Kulczyn'ski, 1887: 276, pl. 8, f. 62-63 (♂, misidentification)
Z. aeneus:- Grimm, 1985: 233, f. 280, 310-311 (♂ ♀)
Z. reconditus:- Di Franco, 2002: 196, f. 1-4 (♂ ♀, misidentification)

Material examined: FRANCE: Pyrénées Orientales: Etang del Vivel /Carlit (2140m.), 42°34'N 01°59'E, 2/7/01, 1 ♀ (last moult 13/7); Forêt des Angles /Matemale (1700m.), 42°33'N 02°04'E, 3/7/01, 6 ♂, 4 ♀ (last moult ♂ 9/7-25/8, ♀ 31/8, two pairs kryo-fixed in mating). Haute-Pyrénées: Pont de Lespitau val. Louron (1360 m.), 42°44'N 00°24'E, 10/7/01, 1 ♂.

Remarks: The material studied by Kulczyn'ski (1887 pl. 8, Figs 62-63) and incorrectly identified as *Prosthesima sarda* clearly belongs to the *Z. subterraneus* group. The shape of the embolus, the length of its embolar base projection and its distribution places it to *Z. aeneus*.

The shape of the embolus illustrated by Di Franco (2002: Fig. 2) of *Z. reconditus* witch is widened at about two third of its length clearly shows a male of *Z. aeneus* (Figs 3, 8; Grimm 1985: Figs 280b - c). In an old mature male those membranous embolar flaps are dark, but in a younger specimen, they are transparent. The males treated by Di Franco were all found in Sicily.

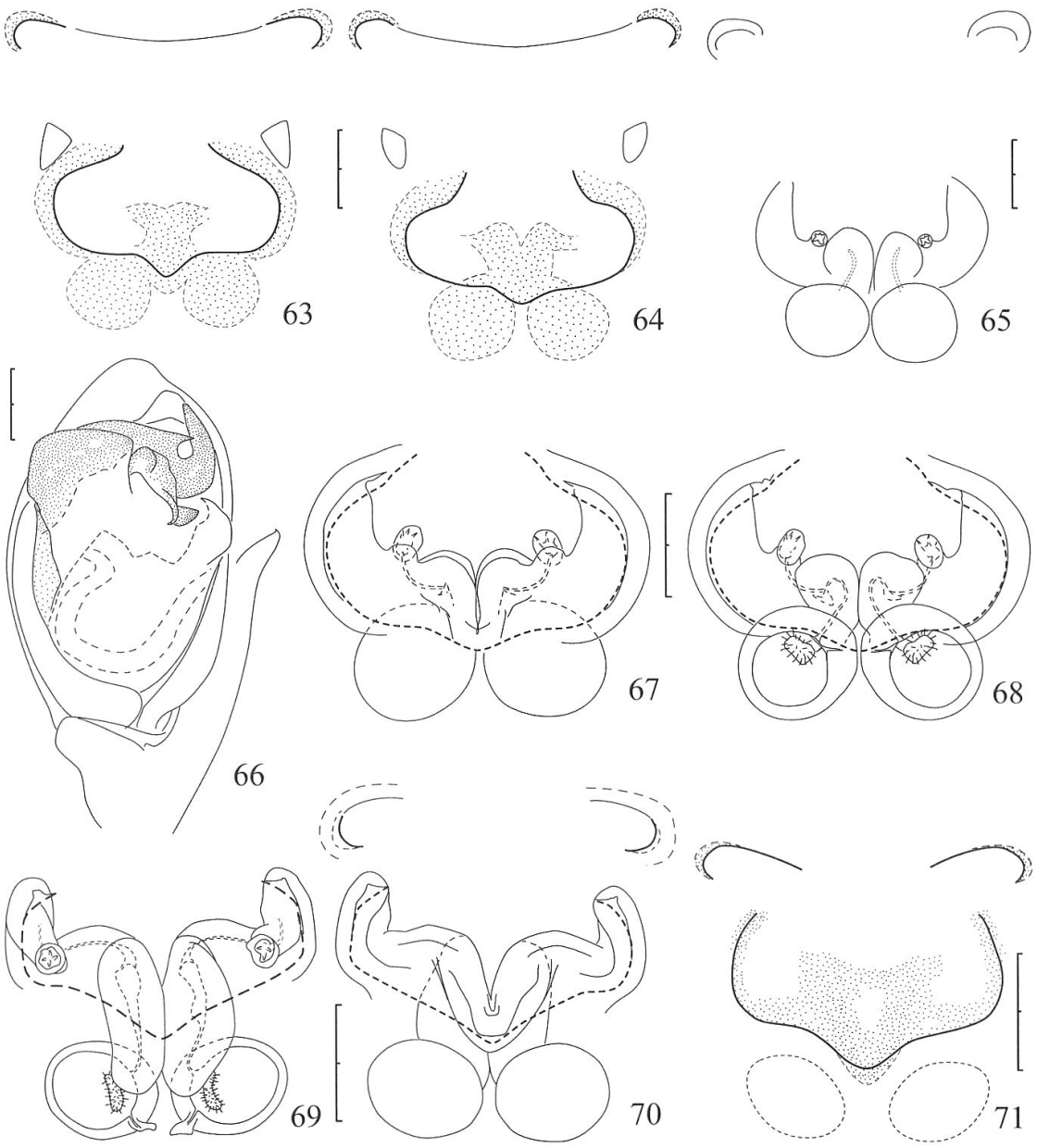
Job erroneously transferred the male of *Z. egregius* to *Z. aeneus* in spite of an embolus lacking the membranous flaps seen in his drawings (1969: Figs 1, 3).

Zelotes apricorum (L. Koch, 1876) (Figs 5-7)

Prosthesima apricorum L. Koch, 1876: 307 (D♀)
Z. louronensis Denis, 1960: 126, f. 1 (D♀) (examined). **Syn. nov.**
Z. louronensis Denis, 1961: 120, f. 3 (♀)
Z. louronensis Jézéquel, 1962b: 606, f. 32 (♀)

Z. apricorum:- Grimm, 1985: 235, f. 10, 276-277, 294-296 (♂ ♀)
Z. lauronensis:- Di Franco, 1992: 223, f. 5-6 (♀)

Material examined: MNHN Paris: tube AR 904, Z. louronensis Denis "Type" 1 ♀; two slides labelled *Z. louronensis* "vulve Type".
FRANCE: Aude: forêt de Carcanet, 42°40'N 02°09'E, 4/7/01, 1 ♂, 1 ♀. Pyrénées Orientales: Les Fourquets (1600m.), 42°26'N 02°23'E, 30/6/01, 3 ♂, 5 ♀ (last moult ♂ 6-14/7). Haute-Pyrénées: Pont de Lespitau val. Louron (1360 m., locus typicus of Z. louronensis), 42°44'N 00°24'E, 10/7/01, 3 ♂, 4 ♀ (last moult 2 ♂ 14-17/7); lac d'Oredon (1850 m.), 42°49'N 00°10'E, 11/7/01, 2 ♂, 11 ♀ (last moult ♂ 18/7, 4 ♀ 13/7-5/8). ANDORRA: rte de La Rabassa (1400m., km. 9.5), 42°26'N 01°30'E, 8/7/01, 1 ♂, 3 ♀ (last moult 2 ♀ 15/7, 18/8).



Figs 63-68: *Zelotes gallicus*; 63-65: females (MNHN, AR 1725); 63: epigynum; 64: id., variant; 65: vulva, dorsal view; 66: left male palp (MNHN, AR 1715), ventral view; 67-68: vulva of Pyrenean female; 67: ventral view; 68: dorsal view. Figs 69-71: *Zelotes cyanescens*; 69: female (from locus typicus of *Z. donnezanus* Denis), dorsal view; 70: id., ventral view; 71: epigynum (MNHN, AR 1719). Bold lines are epigynal folds. Scale lines: 0.2 mm.

Remarks: The study of Denis's type material and the capture of males with characteristic embolus shape and females at the locus typicus leave no doubt about placing *Z. louronensis* in the synonymy of *Z. apricorum*.

Zelotes gallicus Simon, 1914 (Figs 63-68)

Z. gallicus Simon, 1914: 166, 179, 215, f. 338, 381 (D♂ ♀)
Z. pseudoclivicolus Grimm, 1982: 179, f. 15 (D♂ ♀). **Syn. nov.**
Z. pseudoclivicolus:- Grimm, 1985: 252, f. 283, 297-298 (♂ ♀)
Z. pseudoclivicolus:- Heimer & Nentwig, 1991: 444, f. 1179 (♂ ♀)
Z. gallicus:- Di Franco, 2002: 198, f. 9-12 (♂ ♀)

Material examined: MNHN Paris: tube AR 1715, Mont Luberon, 1 ♂, 1 ♀; tube AR 1725, vallée de Tech (Pyrénées or.) 13 ♀, 1 ♂; in addition, 1 slide "coll. Simon" and 1 slide "coll. Denis", Vendée: forêt de la Tranche.
FRANCE: Pyrénées Orientales: Prats de Mollo (700m.), 42°24'N 02°25'E, 29/6/01, 2 ♂, 3 ♀ (last moult ♂ 15/7, 1/8; 2 ♀ 11/8, 10/9); Latour de Carol, 42°28'N 01°53'E, 6/7/01, 1 ♂, 1 ♀ (last moult ♂ 15.9, ♀ 9/8). ANDORRA: La Rabassa (2000m.), 42°26'N 01°32'E, 8/7/01, 1 ♀. SPAIN: ARAGON / NAVARRA: Teruel: Albarracín, 3/9/71, 1 ♂. N. CASTILLA / LA MANCHA: Guadalajara: Anquela del Ducado, 2/9/71, 1 ♀.

Remarks: Zelotes gallicus Simon is abundant in the Pyrenees and *Z. pseudoclivicolus* was described from Catalunia (female holotype from province Barcelona).

Figs 63-64 show two variant epigyna (MNHN AR 1725) and Fig. 65 a vulva (slide coll. Simon). Figs 67-68 (own Pyrenean material) show vulvae in ventral and dorsal view. The male palp (Fig. 66, MNHN, AR 1725) has a variable prolateral lobe of the terminal apophysis masking the prolateral apophysis of the embolar base. This narrow and pointed prong is leaning on the embolar base. The variation shown for the epigynal plate (Figs 63-64) may be seen within a single population.

Zelotes cyanescens Simon, 1914 (Figs 69-71)

Z. cyanescens Simon, 1914: 166, 179, 215, f. 338, 381 (D♂ ♀)
Z. donnezanus Denis, 1961: 118, f. 2 (D♀) (examined). **Syn. nov.**
Z. silvicola Denis, 1962: 673, f. 1 (D♀) (examined). **Syn. nov.**
Z. donnezanus:- Jézéquel, 1962b: 606, f. 33 (♀)
Z. silvicola:- Jézéquel, 1962b: 606, f. 34 (♀)

Material examined: MNHN Paris: one slide *Z. donnezanus* "type Denis"; tube AR 9021, b. 567B, *Z. silvicola* "type Denis"; one slide "*Z. silvicola* = *Z. cyanescens*, type Denis"; *Z. cyanescens*, AR 1719: ♀ ♀ and ♂ ♂ (no palpi); two slides PM 39, *Z. clivicola* renamed *Z. cyanescens*: (Canigou) and PM 44.
FRANCE: Ariège: Etang de Querigut (1880m.), 42°40'N 02°04'E, 5/7/01, 2 ♀, (locus typicus of *Z. donnezanus*).

Remarks: In the absence of male, it does not make sense to redescribe this species. In tube AR 1719 there are two separate palpi of different species without relation to the original description. A comparison of slides PM 39, PM 44 and of the types of Denis's species leaves no doubts about their synonymy with Z. cyanescens. The epigynal plate (Fig. 71, MNHN, AR 1719) is wider than long, and can be even shorter (Fig. 70, bold dotted line), and the anterior anchoring pockets are close to the epigynal plate. Note that the glandular ducts (Fig. 69) are opening

in the anterior part of the lateral pouches. Jézéquel (1962b) mentioned the probable synonymy of *Z. donnezanus* and *Z. silvicola* with *Z. cyanescens*.

Zelotes petrensis group

All species of this group are united by a flange on the embolus and by the posterior sickle-shaped sclerotized lamina on the embolar base. This lamina is used as a posterior backing to the embolar haematodocha. The glandular ducts are situated in the anterior part of the insertion furrow. *Zelotes petrensis* (C. L. Koch) and *Z. sardus* (Canestrini), with the terminal apophysis closely linked to the mesal one and with an apical embolar flap, are clearly separated from the other species of the group. The mesal apophysis of the embolar base is far apart from the terminal one, and a sclerotized ribbon-shaped or a stalked membranous apophysis in the apical third of the embolus are present in *Z. femellus* (L. Koch), *Z. manius* (Simon), *Z. talpinus* (L. Koch), *Z. longipes* (L. Koch), and *Z. hermanni* (Chyzer).

Zelotes sardus (Canestrini, 1873) (Figs 15-18, 72-77)

Melanophora sarda Canestrini, 1873: 46 (D♀)
Prosthesima sarda:- Canestrini, 1876: 206, pl. 10, f. 5 (♀, D♂)
Z. sardus:- Simon, 1914: 164, 176, 216, f. 325-326, 363 (♂ ♀)
Z. sardus:- Jézéquel, 1962b : 602, f. 15 (♀)
Z. brignolii Di Franco & Pantini, 2000: 480, f. 3-4 (D♀). **Syn. nov.**

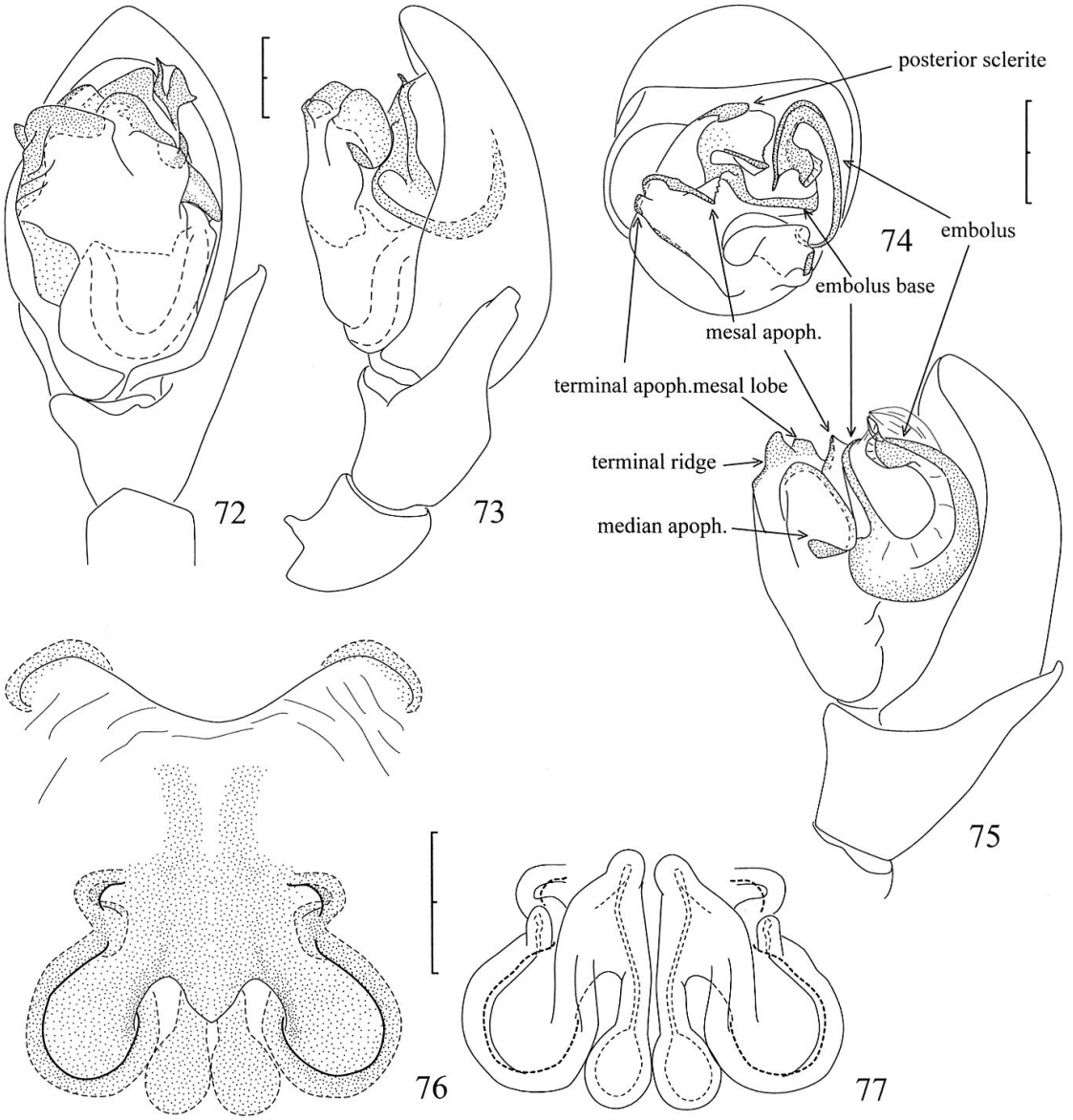
Material examined: FRANCE: CORSICA: Nord Corse: Prunelli di Casacconi /Bastia, 22/5/71, 1 ♀. Sud Corse: L'Ospedale /Porto Vecchio, 27/5/71, 4 ♀; Zonza, 28/5/71, 1 ♀; col de Bavella (1200m), 18/6/99, 1 ♂, 4 ♀ (Last moult ♂ 24/7, 1 ♀ 15/9); forêt de Zonza (moss), 19/6/99, 2 ♀ (last moult 6-16/8). ITALY: SARDINIA: Sassari: Castelsardo, 6/9/68, 3 ♂, 1 ♀; Ozieri, 23/9/68, 4 ♂, 5 ♀; rte de Mt. Limbara (1000m), 27/5/99, 1 ♀; Mt. Limbara (1300m.), 27/5/99, 3 ♀. Nuoro: Monte Spada /Gennargentu (1380m.), 5/6/99, 1 ♂, 5 ♀ (last moult ♂ 20/7, 1 ♀ 3/9); Bruncu Spina /Gennargentu (1500m.), 6/6/99, 2 ♂, 2 ♀ (last moult ♂ 19-23/7); Cala Ginepro /Orosei, 10/6/99, 1 ♂, 2 ♀ (last moult ♂ 16/9). Oristano: Oristano (Ollastra), 20/9/68, 1 ♂; stagno San Giusta, 1/6/99, 1 ♀.

Remarks: The original drawing of the epigynum (Canestrini, 1873, Fig. 5) leaves no doubt about the identity of this species.

Redescription: Male: Total length. Prosoma 2.8 long, 2.2 wide. Eye sizes and interdistances: AME 0.07, ALE 0.1, PME 0.1, PLE 0.1; AME-AME 0.06, AME-ALE 0.015, PME-PME 0.04, PME-PLE 0.05, ALE-PLE 0.1. MOQ length 0.31, front width 0.43, back width 0.51. Embolus with a flange and an apical membranous flap (Figs 74-75). Narrow mesal apophysis base directly linked to the terminal apophysis (Fig.18). Tibial apophysis strong and relatively short (Figs 72-73). Patella dorsally a little longer than tibia; tibia wider than long. Scutum longer than 1/3 of opisthosoma.

Female: Total length 5.7. Prosoma 2.5 long, 1.8 wide. Eye sizes and interdistances: AME 0.07, ALE 0.1, PME 0.07, PLE 0.07; AME-AME 0.07, AME-ALE 0.02, PME-PME 0.04, PME-PLE 0.03, ALE-PLE 0.07. MOQ length 0.29, front width 0.37, back width 0.44. Epigynum (Figs 23, 76) longer than wide, with a sinuous anterior margin and large-sized anchoring pockets. Epigynal plate expanded on the side of the spermathecae into two larges lateral lobes bordered by the insertion furrows. Epigynal plate with two lateral anchoring pockets.

Prosoma dark brown, with medium sized black prostrate hairs, and sparse longer bristles. Opisthosoma blackish, covered with black hairs. Clypeus about ALE diameter.



Figs 72-77: *Zelotes sardus*; 72-75: left male palp; 72: ventral view; 73: retrolateral view; 74: bulbus slightly expanded, apical view; 75: id., retrolateral-apical view; 76: epigynum; 77: vulva dorsal view. Bold lines are epigynal folds. Scale lines: 0.2 mm.

Zelotes manius (Simon 1878) (Figs 78-84)

Prosthesima mania Simon 1878: 59, pl. 14, f. 12-13 (D♂ ♀)
Z. manius:- Simon 1914 :163, 177, 214, f. 323, 372 (♂ ♀)
Z. manius:- Jézéquel 1962b: 598, f. 4 (♀)

Material examined: FRANCE: Pyrénées Orientales: Latour de Carol, 42°28'N 01°53'E, 6/7/01, 3 ♂, 7 ♀ (last moult ♂ 22/7-19/8, 2♀ 7-9/9). ANDORRA: La Rabassa (2000m.), 42°26'N 01°32'E, 8/7/01, 3 ♂ (last moult 19-28/8); O. de St Julià de Loria (1400m.), 42°27'N 01°28'E, 29/6/02, 1 ♀ (last moult 11/9). SPAIN: ANDALUSIA: Granada: Puerto de la Ragua (2000m.), 37°07'N 03°02'E, 24/5/02, 1 ♀ (♀ 25/8). PORTUGAL: TRAS-OS-MONTES: Vila Real: Vilarandelo - S.Lourenço /Chaves, 29/8/69, 1 ♂.

Diagnosis: Male pedipalp has a very large terminal apophysis with a rounded tip and an apical median apophysis; Female insertion furrow situated in the poste-

rior half of the fold. Median ducts of the vulva (Fig. 84) wide. In the close related species, *Z. talpinus* have a pointed large terminal apophysis. Female insertion furrow is at the posterior margin of the epigynal fold and the median ducts are narrower (Figs 86-87), and the median anchoring pocket in the posterior part of the epigynal plate.

Redescription: Male (Figs 78-82): Total length 5.6. Prosoma long 2.6, wide 2. 0. Eye sizes and interdistances: AME 0.06, ALE 0.1, PME 0.08, PLE 0.08; AME-AME 0.6, AME-ALE 0.0, PME-PME 0.3, PME-PLE 0.4, ALE-PLE 0.6. MOQ length 0.31, front width 0.36, back width 0.43. Terminal apophysis much enlarged, dorsally concave with short teeth, far apart from the large mesal apophysis of the embolar base. Sclerotized ribbon-shaped apophysis in the apical third of the embolus. Tibial apophysis strong, short. Patella dorsally slightly longer than tibia; tibia shorter than wide. Scutum longer than 1/3 of opisthosoma.

Female: Total length 5.7. Prosoma 2.9 ± 0.4 long, 2.2 ± 0.4 wide. Eye sizes and interdistances: AME 0.07, ALE 0.13, PME 0.1, PLE 0.1; AME-AME 0.07, AME-ALE 0.1, PME-PME 0.06, PME-PLE 0.08, ALE-PLE 0.11. MOQ length 0.38, front width 0.44, back width 0.57. Anterior anchoring pockets of epigynum (Fig. 83) wide apart; shape of the anterior part of epigynal plate variable because of parallel to diverging folds; insertion furrow situated in the posterior half of the fold. Median ducts of the vulva (Fig. 84) wide.

Prosoma dark brown-black, with black hairs; opisthosoma black, with black hairs. Clypeus about ALE diameter. In one population, the males are clearly smaller than the females. Metatarsi: I v2-0-0/1-0-0, II v2-2-0.

Zelotes femellus (L. Koch, 1866) (Figs 88-94)

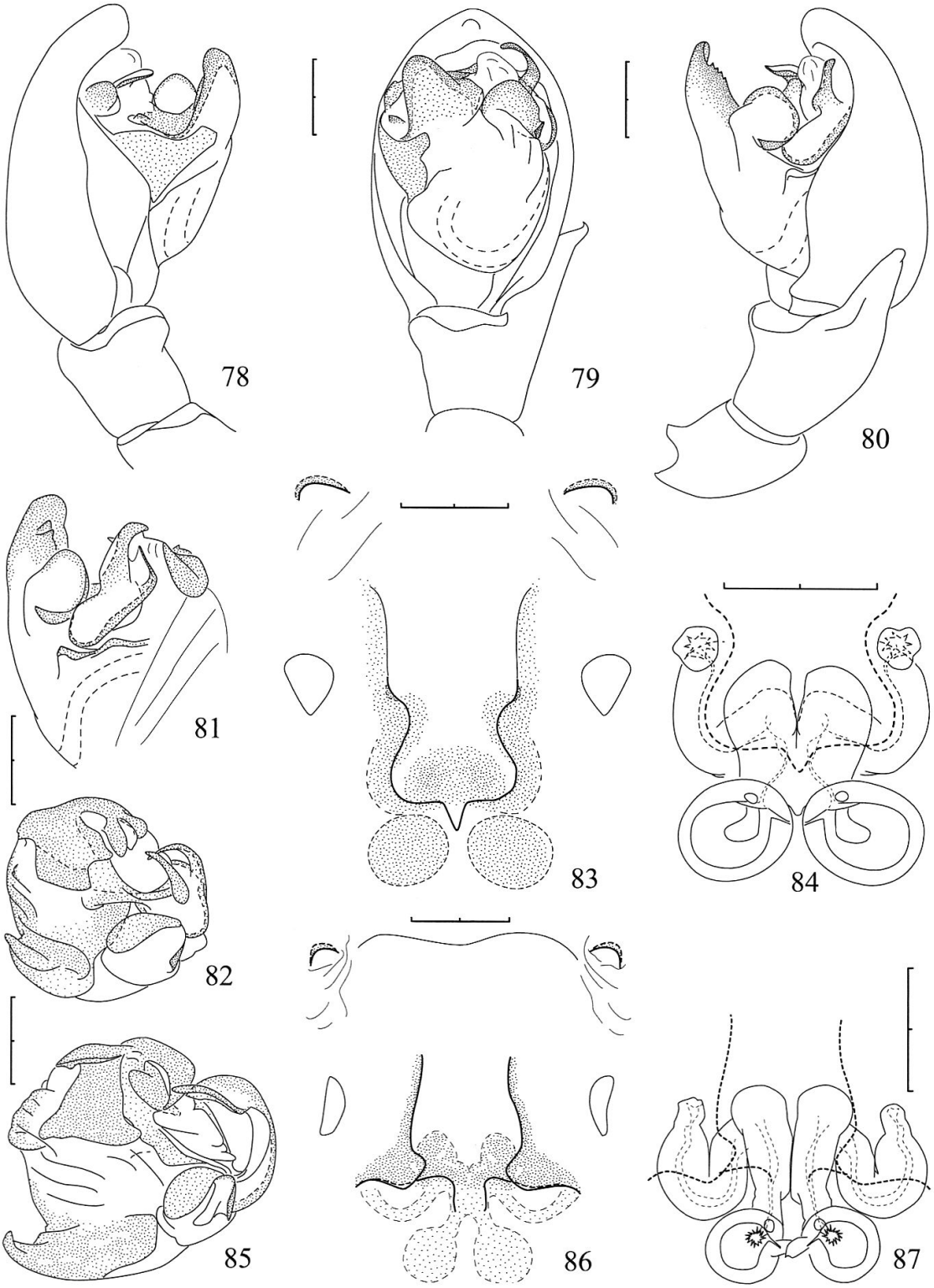
Melanophora femella L. Koch, 1866: 176, pl. 7, f. 114 (D♀)
Z. femellus:- Simon, 1914: 174, 216, f. 362-363 (♀)
Z. femellus:- Jézéquel, 1962b: 602, f. 16 (♀)
Z. femellus:- Di Franco, 1989b: 71, f. 5-6 (D♂)

Material examined: FRANCE: CORSICA: Sud Corse: Ajaccio (riv. Gravone à 12km., 1/6/71, 1 ♀. ITALY: SARDINIA: Sassari: Palau (riv. Liscia), 8/9/68, 1 ♂, 1 ♀; Ozieri, 23/9/68, 1 ♀; Porto Tórres (riv. Riu Mannu), 25/9/68, 1 ♀. Nuoro: lago alto de Flumendosa, 8/6/99, 1 ♀; Cagliari: San Vito (riv. Flumendosa), 13/9/68, 2 ♂; Muravera (riv. Sa Picocca), 14/9/68, 1 ♀.

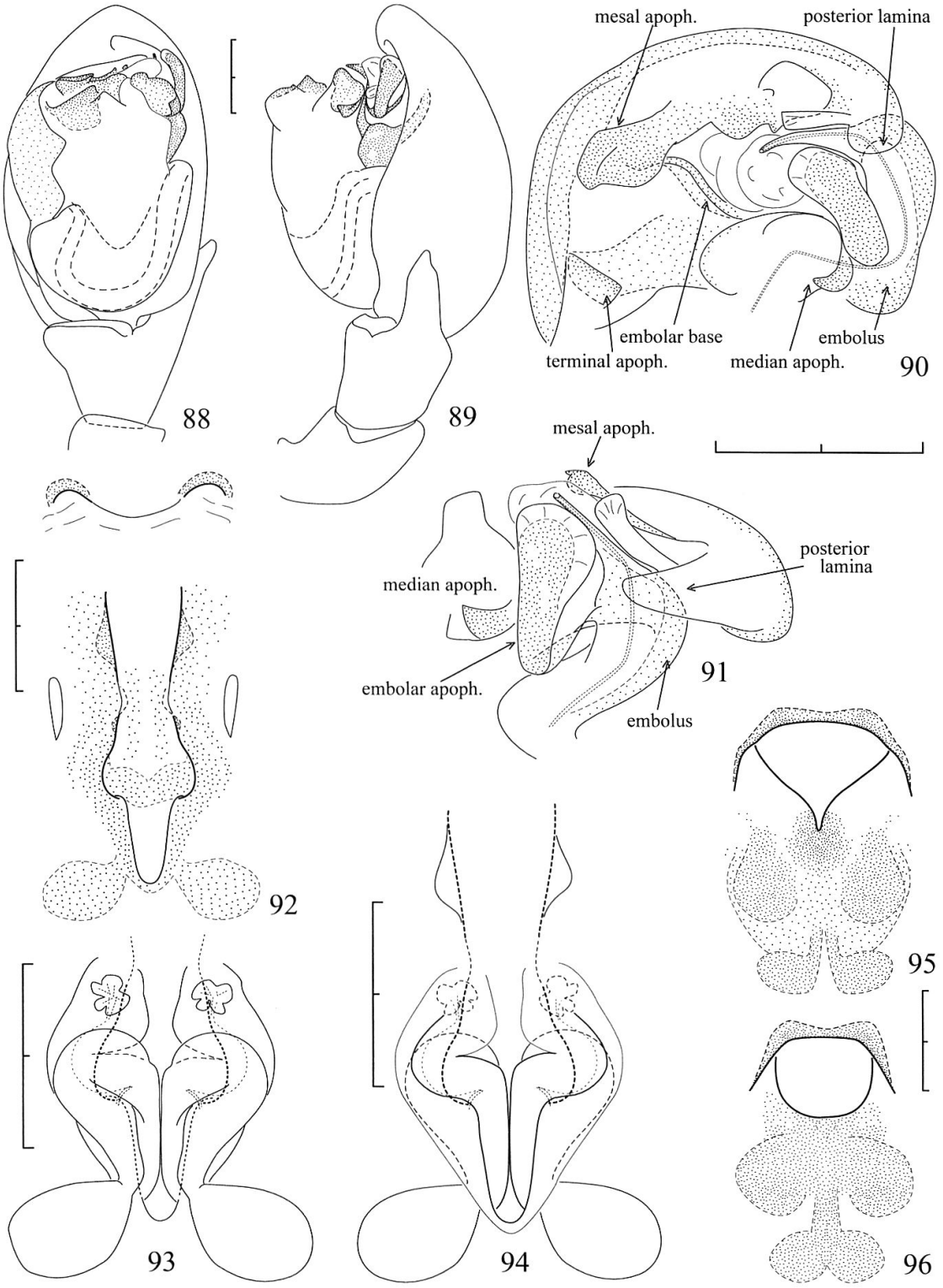
Redescription: Male: Total length 6.5. Prosoma 2.7 long, 2.0 wide. Eye sizes and interdistances: AME 0.07, ALE 0.1, PME 0.08, PLE 0.07; AME-AME 0.03, AME-ALE 0.01, PME-PME 0.04, PME-PLE 0.05, ALE-PLE 0.08. MOQ length 0.41, front width 0.38, back width 0.44. A sclerotized ribbon-shaped apophysis present on the apical third of the embolus (Figs 88-91) as in *Z. talpinus* and *Z. manius*. Terminal apophysis of medium size, far apart from the mesal apophysis of the embolar base. Tibial apophysis short. Patella dorsally 1.5 times longer than tibia; tibia shorter than wide. Brown scutum covering 1/3 of the opisthosoma.

Female: Total length 7.0 ± 1.0. Prosoma 2.5 ± 0.5 long, 1.8 ± 0.4 wide. Eye sizes and interdistances: AME 0.07, ALE 0.14, PME 0.1, PLE 0.1; AME-AME 0.05, AME-ALE 0.0, PME-PME 0.025, PME-PLE 0.05, ALE-PLE 0.08. MOQ length 0.27, front width 0.4, back width 0.5. Epigynum long and narrow (Fig. 92); two lateral anchoring pockets present in the anterior part of the epigynal folds. Insemination ducts opening at the posterior 3/4 of the vulva (Figs 93-94).

Prosoma dark brown; opisthosoma blackish, with black bristles. Tarsus and metatarsus I, II scopulate. Two teeth on ventral margin of chelicera.



Figs 78-84: *Zelotes manius*; 78: Left male palp, prolateral view; 79: id., ventral view; 80: id,. retrolateral view; 81: palp with discarded cymbium, retrolateral-apical view, 82: id., apical view; 83: epigynum; 84: vulva, dorsal view. Figs 85-87. *Zelotes talpinus*; 85: left male palp apical view, cymbium discarded; 86: epigynum; 87: vulva, dorsal view. Bold lines are epigynal folds. Scale lines: 0.2 mm.



Figs 88-94: *Zelotes femellus*; 88-91: left male palp; 88: ventral view; 89: retrolateral view; 90: bulbus, apical view; 91: id., retrolateral view; 92: epigynum; 93: vulva, dorsal view, 94: id., ventral view. Figs 95-96: *Zelotes caucasius*, two epigyna. Bold lines are epigynal folds. Scale lines: 0.2 mm.

Zelotes gracilis group

Zelotes caucasius (L. Koch, 1866) (Figs 95-96)

Melanophora caucasia L. Koch, 1866: 144, pl. 6, f. 87 (D♀)
Prosthesima callida Simon, 1878: 91, pl. 14, f. 24 (♀, misidentification, not ♂, f. 23)
Prosthesima tarsalis Simon, 1878: 92, pl. 14, f. 25 (D♀)
Z. callidus:- Simon, 1914 : 172, f. 354 (♀, misidentification)
Z. callidus:- Jézéquel, 1962b : 604, f. 29 (♀)
Z. caucasius:- Jézéquel, 1962b: 603, f. 23 (♀)
Z. caucasius:- Grimm, 1985: 281, f. 231, 234-235 (♂ ♀)
Z. caucasius:- Levy, 1998: 137, f. 92-96 (♂ ♀)

Material examined: MNHN Paris: slide *Z. callidus*, PM 51 b. 567, (Jézéquel, 1962b, fig. 29);
SPAIN: N. CASTILLA / LA MANCHA: Albacete: La Gineta (rio Jucar) (fine dry leaves litter), 39°10'N 01°58'W, 16/5/02, 2 ♂ (last moult 10-16/7); Ciudad Real: Fuencaliente, 3/8/69, 3 ♀; Ruidera, 7/8/69, 1 ♀. ANDALUSIA: Granada: La Vidriera /Pto del Pinar, 38°03'N 02°34'W, 20/5/02, 1 ♀ (last moult 5/7); Collado del Muerto (S. Nevada) (1450m.), 37°08'N 03°28'W, 29/5/02, 2 ♂ (last moult 13, 22/7); Sevilla: Pantano del Pintado /Cazalla de la Sierra, 2/7/69, 1 ♂, 1 ♀; Huelva: Santa Olalla (rio Cala), 37°55'N 06°11'W, 4/7/69, 1 ♂.

Remarks: The original description of *Z. callidus* was made on a male certainly not conspecific with the female syntype. Fig. 24 in Simon (1878) clearly shows a female close to *Z. caucasius*, and the material seen from the coll. Simon leaves no doubt about placing the female syntype of *Z. callidus* in *Z. caucasius*. I have been able to study an extensive material of this species collected by myself in Greece. The Figs 95-96 give two extreme examples of a highly variable epigynum, in which every intermediate stage exists. Only the arched anterior margin and the less marked anchoring pockets permit to distinguish these females from those of the close-related *Z. solstitialis* Levy (1998). The male of *Z. callidus* is unavailable.

Zelotes segrex (Simon, 1878) (Figs 97-101)

Prosthesima segrex Simon, 1878: 49, pl. 14, f. 9 (D♂)
Prosthesima declinans Kulczyn'ski, in Chyzer & Kulczyn'ski, 1897: 205, pl. 8, f. 3 (D♀). **Syn. nov.**
Z. segrex:- Simon, 1914: 160, 217, f. 313 (♂)
Z. labilis Simon, 1914: 167, 219 (D♀) (examined). **Syn. nov.**
Z. labilis:- Jézéquel, 1962a: 529, f. 15 (♀)
Z. declinans:- Soyer, 1967: 280, f. 14-16 (♀)
Z. declinans:- Grimm, 1985: 196, f. 247, 252-253 (♂ ♀)
Z. labilis:- Di Franco, 2002: 199, f. 13-16 (♂ ♀)

Material examined: MNHN Paris: tube AR 1863, *Z. segrex*, without locality, 1 ♂, presumably holotype; tube AR 1766, *Z. labilis*, Massane Pyrénées Or., 1 ♀ (epigynum missing); slide PM 40 (holotype).
SPAIN: ANDALUSIA: Granada: Pradollano (Sierra Nevada) (stones, dwarf Juniperus, 2350m.), 37°07'N 03°24'E, 28/5/02, 4 ♂, 2 ♀ (last moult ♀ 1/6). Huelva: Alajar /Aracena, 37°52'N 06°41'E, 7/7/69, 1 ♂.

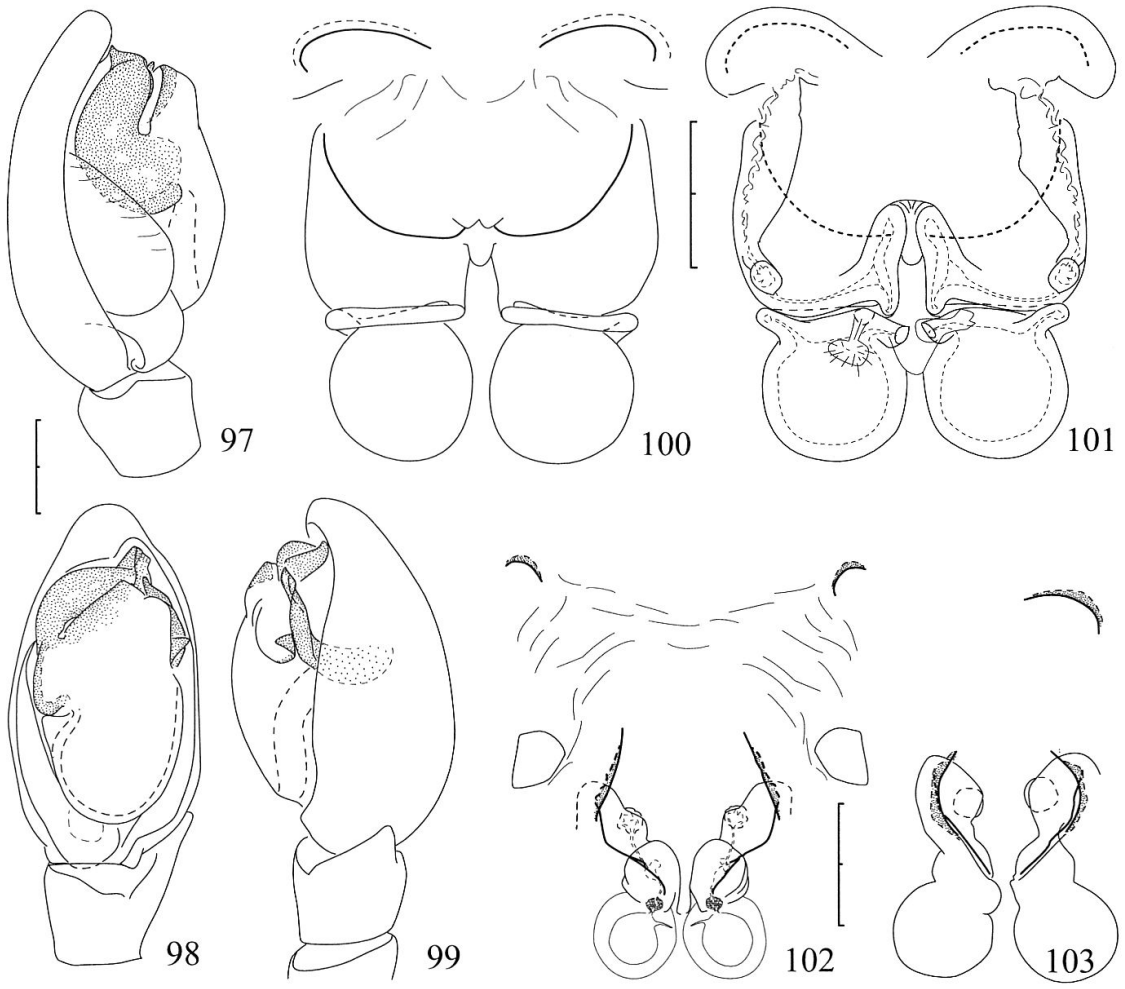
Remarks: The type specimen is yellow coloured (bleached) and some legs are missing; two IV and one III legs are remaining. The fresh Spanish specimens are all dark coloured with the prosoma dark brown and sternum more dark yellow. The legs equally dark brown have the coxae, metatarsi and tarsi slightly lighter. Small scutum on black male opisthosoma.

Zelotes latreillei (Simon, 1878) (Fig. 102-103)

Prosthesima latreillei Simon, 1878: 62 (D♂ ♀)
Zelotes egregius:- Simon, 1914: 174, f. 361 (♀, misidentification)
Zelotes latreillei:- Jézéquel, 1962: 597, f. 2 (♀)
Zelotes latreillei:- Grimm, 1985: 201, f. 2, 7, 9, 220-221, 241, 258-259 (D♂ ♀)
Zelotes egregius:-Jézéquel, 1962: 602, f. 18 (♀)
Zelotes egrigius:- Job, 1969: 378 (♀, misindentification based on Simon's original drawings)

Material examined: MNHN Paris: slide PM 55, *Z. egregius* "vulva coll. Simon" syntype.
PORTUGAL: TRAS-OS-MONTES: Vila Real: Cortico /Montalegre (900m.), 30/8/69, 1 ♀; FRANCE: LANGUEDOC: Aude: forêt de Carcanet (pasture), 42°41'N 02°08'E, 4/7/01, 1 ♂, 6 ♀, (last moult ♂ 24/8, 2 ♀ 30/8-22/9,); forêt de Carcanet (side of pasture), 42°40'N 02°09'E, 4/7/01, 1 ♂, 1 ♀, (last moult ♂ 15/8, ♀ 15/9); Pyrénées Orientales: sur Les Fourquets (1800m.), 42°26'N 02°25'E, 30/6/01, 1 ♀; Les Fourquets (1600m.), 42°26'N 02°23'E, 30/6/01, 1 ♂ (last moult 20/8); Forêt des Angles /Matemale (1700m.), 42°33'N 02°04'E, 3/7/01, 2 ♀.

Remarks: Epigynal plate with lateral sclerotized ridges of variable length; shallow epigynal folds initialising below the ridges (Fig. 102). The study of the female syntype of *Z. egregius* (Fig. 103) showed an anomalous epigynum; its posterior part



Figs 97-101: *Zelotes segrex*; 97: left male palp (type MNHN, AR 1863), prolateral view; 98: id., ventral view; 99: id., retrolateral view; 100: vulva, ventral view; 101: id., dorsal view. Figs 102-103: *Zelotes latreillei*, vulva ventral view; 103: "*Z. egregius*" (MNHN, PM55). Bold lines are epigynal folds. Scale lines: 0.2 mm.

and the vulva correspond entirely with *Z. latreillei*; the anterior malformed part have a unique large anterior pocket situated on the side, near the centre; the deformed part is reaching to the fore extremities of the lateral sclerotized ridges. The unbroken cuticula of the mounted epigynum is proof of an anomaly. The malformed anterior epigynal rim explains the original drawing (Simon 1914: Fig. 361).

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RÉSUMÉ

Les mécanismes de l'accouplement de *Zelotes*, *Drassyllus* et *Trachyzelotes* sont décrits sur les genitalia de couples cryofixés *in copula*, et lyophilisés. Dans l'accouplement, l'apophyse tibiale du pédipalpe mâle est utilisée comme fixation primaire dans un alvéole d'ancrage antérieur de l'épigyne, permettant ensuite l'intromission.

L'apophyse médiane du tégulum (retinaculum) est utilisée comme conducteur fonctionnel, temporairement pour l'intromission chez les Zelotinae, mais restant fixé au bord de l'atrium chez *Haplodrassus*. Chez tous les Zelotinae étudiés, l'embolus est connecté à la base tégulaire dorsale par une forte sclérite, le radix embolique, généralement non visible sur un pédipalpe au repos. L'embolus est articulé à la base ventrale prolatérale du tégulum par l'intermédiaire de la base embolique, à travers la sclérite intercalaire chez *Zelotes* ou directement chez *Drassyllus* et *Zelotes caucasius* (groupe *gracilis*). Dans les vraies *Zelotes* en addition à la sclérite intercalaire un possible synapomorphisme pourrait être la liaison de l'apophyse terminale du tégulum à la base tégulaire dorsale par une sclérite interne; cette dernière est absente chez *Drassyllus*.

Le pli épigynal latéral dans le groupe petrensis (*Zelotes hermanni*, *Z. femellus*, *Z. longipes*, *Z. manius*, *Z. petrensis*, *Z. sardus* et *Z. talpinus*) s'ouvre sur un sillon dans lequel l'embolus est inséré. Chez *Z. fuscorufus* (groupe *tenuis*), *Z. apricorum* et *Z. aeneus* le pli épigynal latéral s'ouvre sur une poche dans laquelle la base embolique est insérée. Chez *Z. apricorum* et *Z. aeneus*, l'embolus est inséré séparément dans un pli secondaire postérieur.

Les espéces suivantes sont placées en synonymie: *Zelotes brignolii* Di Franco & Pantini = *Z. sardus* (Canestrini); *Z. donnezanus* Denis et *Z. silvicola* Denis = *Z. cyanescens* Simon; *Z. declinans* (Kulczyn'ski) et *Z. labilis* Simon = *Z. segrex* (Simon); *Z. louronensis* Denis = *Z. apricorum* (L. Koch); *Z. adolescentulus* Denis, *Z. lugens* Denis et *Z. massiliensis* Soyer = *Z. ruscinensis* Simon; *Z. pseudoclivicolus* Grimm = *Z. gallicus* Simon; *Z. reconditus* Simon = *Z. egregius* Simon. La femelle syntype de *Z. callidus* (Simon) est placée dans *Z. caucasius* (L. Koch). Des lectotypes sont désignés pour *Z. egregius* Simon et *Z. reconditus* Simon.

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