

Observations on the behaviour of *Ariasella lusitanica*, Grootaert *et al.*, 2009 (Diptera, Hybotidae, Tachydromiinae) from Portugal

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Abstract

In this work, done entirely under field conditions, the behaviour of a recently described species of hybotid dipteran from Portugal is described, with information about several of its behaviours: sexual, feeding, resting, defensive and attacking behaviour, with new data relative to its distribution and phenology. The many aspects of the behaviour of this species were recorded on photo or video.

Keywords: Diptera, Hybotidae, *Ariasella lusitanica*, behaviour, distribution, phenology, Portugal.

Introduction

The species here studied, *Ariasella lusitanica* Grootaert *et al.*, 2009, belongs to the Tachydromiinae (Diptera: Hybotidae), whose members are, during their adult stage, mostly quick predators which move running across the ground, leaf surfaces, rocks and tree barks (CHVÁLA, 1975). This species is small (about 2 mm in length), with a blackish body, and shows brachypterism in both sexes. The male wings are stalk-like in appearance, very thin at the base, with its distal portion attaining a bilobed, club shape; the female has a very atrophied and scale-like pair of wings; neither have halteres (GROOTAERT *et al.*, 2009). It's possible to encounter various examples of brachypterous species among the Tachydromiinae, but the reasons for this are not yet very well understood (see Grootaert & Shamshev, 2008 for a discussion of this phenomena in Empidoidea).

The only known description of the behaviour of a "Tachydromia-like" wingless species (of the genera *Ariasella* and *Pieltainia*) that I have come across is the one by J. Arias, written based on the observations made by the Spanish entomologist Bolívar y Pieltain of the species *Pieltainia iberica* Arias, 1919. In this description he mentions the great voracity and agility with which this species moves through the ground (resembling small ants) and the frequency with which individuals were observed feeding on other dipterans (ARIAS, 1919).

Materials and methods

This study was made in a small private property (with an area of about 7000 m²) in the parish of Gilmonde (the type locality of the species, GROOTAERT *et al.*, 2009), Barcelos municipality, on the district of Braga in the North of Portugal (41°30'42.10"N; 8°38'57.81"W). The site's altitude is about 50 m above sea level. All the observations were recorded in field conditions, in an area which was formerly heavily forested, but was perturbed by construction work, and that presently exhibits mostly transitional vegetation (with a small standing patch of forest), in which the following plant species are dominant: *Pinus pinaster*, *Eucalyptus* sp., *Acacia* sp., *Ulex* spp., *Cytisus* sp., Ericaceae, *Quercus robur* and the ornamental *Prunus lusitanica* (Fig. 1a). The latter's specimens form a hedge along a wall creating below them a suitable environment for *A. lusitanica*, with a great deal of organic matter, humidity and shadow, so in this area the fly is very numerous (Fig. 1b). In the drier area *A. lusitanica* is less abundant, but it still can be found sporadically and several meters away from the more humid environment (as we move away from the *P. lusitanica* hedge it becomes increasingly difficult to find it).

The observations were made at a minimal distance of 12 cm (distance between the photographic camera lens and the fly), in the years



Fig. 1. Some habitats where *Ariasella lusitanica* has been found: a) the type locality and the place where the present study was conducted (in Gilmonde, Barcelos); b) detail of the suitable habitat found below some *Prunus lusitanica* in the study site; c) landscape in Campo, Valongo; d) path on which margins *A. lusitanica* was found in Santa Maria do Bouro, Amares

2008 (occasional observations), 2009 (between the 17th of February and 29th of April) and 2010 (between March 11th and March 28th, and occasional observation in April); the observations made in 2009 and 2010 were more systematic. All the observations were recorded in writing in a notebook, photo or film. Photography and film were done using a Fujifilm Finepix S5500 camera, with a Raynox DCR-250 macro lens. The videos are available, numbered, on the internet (<http://www.youtube.com/user/ariasellaportugal>).

Distribution

I add here, beyond the type locality for this species (Gilmonde), the record for two more sites where the presence of this species was confirmed: one North of Gilmonde, and one to the South. The southern locality, Campo, Valongo, Porto, Portugal (41.156587°N; 8.483942°W) is located near the town of Porto, at an altitude of 50 m. Specimens were observed on the margins of a small river, Rio Ferreira, running about in the fallen leaves of *Quercus robur*, and also, in smaller numbers, in the area with heath and gorse. Besides this plant species, one can also find the

plants *Rubus* sp. and *Hedera* sp. As we go up the mountain side, *Eucalyptus* sp., *Ulex* sp., *Pterospartum tridentatum*, *Calluna vulgaris* and other species of heather are common (Fig. 1c).

The other locality, Santa Maria do Bouro, Amares, Braga, Portugal (41.664589°N; 8.268486°W) is located near the Peneda-Gerês National Park, at an altitude of about 150 m. It's a rural locality in a granitic mountainous region with some agricultural fields and orchards, crossed by small streams, with the following plant species: *Quercus robur*, *Salix* sp., *Platanus* sp., *Citrus* sp. and *Rubus* sp. (Fig. 1d).

Phenology

Adults are only active, at the study site, from the end of winter to the middle of spring, on a time span that lasts about 3 months. The earliest occurrence of this species was recorded on the 10th of February (in 2011), and the latest in the 6th of May (in 2008). When they appear in middle February, adults can be found usually in small numbers. On 17.II.2009 there were only 3 specimens (all females), and in 12.II.2010 there was only a single female moving through leaf

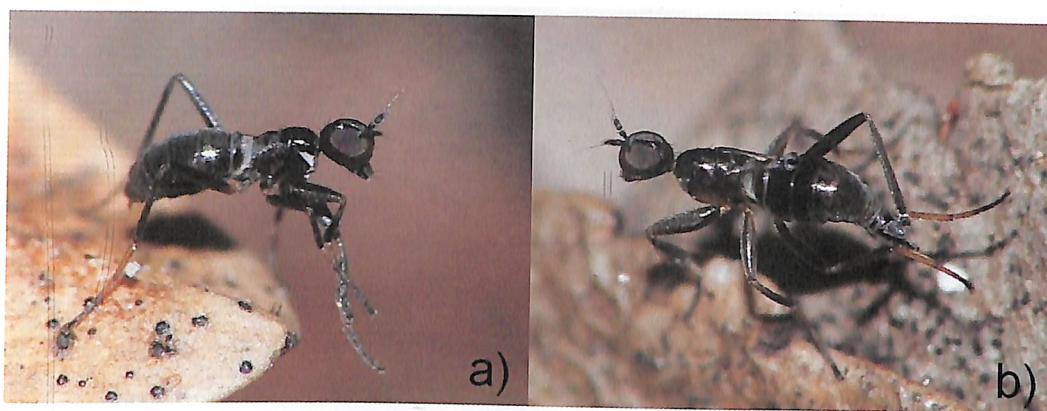


Fig. 2. Cleaning behaviour in *Ariasella lusitanica*: a) a female pushes the right mid leg forward to assist in cleaning the fore legs; b) a male cleans its genitalia using the hind legs.

litter, and the following day a single male was seen. On 10.II.2011 4 specimens were seen.

As the days pass and the temperature rises, the number of specimens rises accordingly. On 23.II.2009 it's already possible to see many specimens on a single day, and at some point it was possible to see three simultaneously. In February mornings are still cold, so only by the middle of the day it is possible to see specimens more regularly. On 24.II.2009, at about 15h00, there were still a good number of specimens, but by 16h00 the temperature drop meant it was very difficult to find specimens. On 27.II.2009 three 20 minute searches were made from the period between 8h30 and 11h45, yielding 3 specimens in total, but by 13h50 a great number of specimens was seen, frequently 3 or 4 at the same time. As much as 6 specimens were seen simultaneously on 09.III.2008.

On 06.V.2008 I looked intensively for specimens from 8h00 until 18h00 and only 3 specimens were seen (2 females and 1 male), two of them at 17h40. A similar search was conducted the following day but no specimens were found. In 2009, no rigorous search was conducted to determine when the adults disappear, but their last record is on 29.IV.2009, and the following search in 04.V.2009 yielded no specimens.

It should be mentioned that all these records were not done in a thoroughly systematic way, so should not be seen as having statistic value, but a rather more indicative one.

General behaviour

A. lusitanica is a species that lives on the ground, running agilely among fallen leaves in mostly humid environments with shadow and organic matter. As it moves, it's evident the way in which its abdomen goes up and down,

resembling in this respect small wasps (video 55). Despite living on ground level most of the time, on some occasions I saw specimens walking on shrub twigs and leaves, sometimes up to 1 m above the ground, and even on walls and a house window. It spends an important portion of its time resting (many times facing down) on the same spot, grooming itself frequently. On some occasions, mostly in sun exposed places, the specimens rest in more sheltered locations, under leaves or twigs.

The legs are cleaned by rubbing them against each other. The fore legs rub each other, with one of the mid legs being pushed forward to join them (Fig. 2a). The hind legs are also rubbed on each other, and in a similar way to the fore legs, one of the mid legs joins them. When it finishes cleaning the hind legs, *A. lusitanica* rubs them on the ground to clean them. The head is cleaned by the fore legs. The abdomen is cleaned mainly using the hind legs, with the fore legs used to clean the ventral surface of it, pushing them along the body. The genitalia is cleaned with the hind legs (Fig. 2b). I never managed to notice clearly any instance of *A. lusitanica* cleaning the thorax, though it is possible that when it rubs the fore legs under the body it could be cleaning it (see this behaviour in particular on video 38). The tarsi (mainly the first tarsomer in the hind legs) are the main rubbing surface used, both between them and for the other parts of the body. When it's feeding, the fly doesn't clean itself with the fore legs, using only the mid and hind legs (see videos 5, 16, 26, 31, 38, 39, 53, 78, 79, 97, 99, 102, 110 and 138). During copula a female was observed cleaning itself using the three pairs of legs, and cleaning its head (videos 108 and 109). Most of these grooming observations match those recorded by Wuellner *et al.* (2002) for Phoridae, which suggests a similar pattern among different dipteran families.

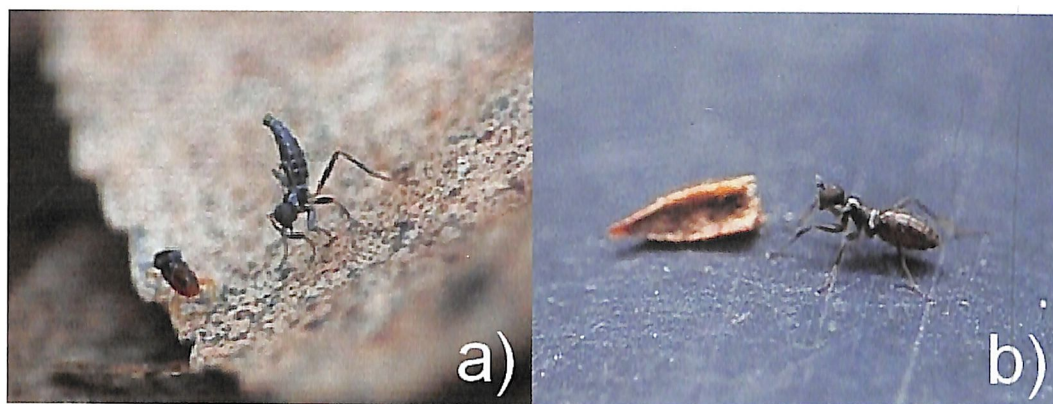


Fig. 3. Video captures showing *Ariasella lusitanica* defensive and attacking behaviours: a) a male waves the abdomen up and down defensively while a small heteropteran passes nearby; b) a female performs an attack simulation on an object.

Defensive and aggressive behaviour

Regarding the defensive behaviour of this species, on many occasions I had the opportunity to observe males that, when another insect crossed their path, raised and stretched the abdomen, waving it up and down intensely and exposing the genitalia, a behaviour that subsided when the threat walked away (Fig. 3a). Sometimes, after this exhibition, specimens would follow the other insect for a moment, but quitting soon after (videos 51, 144 and 147). When females feel agitated about the approximation of a possible threat, they wave their abdomens up and down like the males (but not stretching the abdomen), sometimes raising their fore and mid legs to keep the threat away (videos 65, 131, 143 and 145). Many times when I tried to collect a specimen it would very quickly and nervously shelter beneath objects in the ground. When found on a wall, they will seemingly intentionally drop when very disturbed.

I have seen, in both sexes, a curious behaviour they do while running about, which consists on a kind of attack simulation in which, after oscillating laterally, they do a sudden forward jump, and then happily follow their way (Fig. 3b). This behaviour has been seen being directed to other *A. lusitanica* (video 163), other insects (video 131), inanimate objects (videos 106, 136 and 164), and even seemingly in the absence of any object (video 168). Besides these video examples, many more observations were made. This behaviour differs from typical defensive and mating behaviour; the fact that they use it against objects could suggest they mistake them for other animals, but I have seen *A. lusitanica* specimens detecting and recognizing others of the same species or other insects from similar or greater

distances, and acting accordingly. Andreas STARK (pers. comm.) has reported observing *Platypalpus* specimens attacking “dust-particles” of roughly 1 mm diameter, dead plant parts, and rarely, individuals of the same species. This seems to match the observations I’ve made in *A. lusitanica*.

Feeding behaviour

This species is predatory, in both sexes, on small dipterans with a size about the same, or smaller than itself (it’s frequent in other Tachydromiinae for the prey to be larger than the predator, see CHVÁLA, 1975). It is very voracious, and even when in captivity, if proper prey is given, the fly will readily attack it. All observed prey were small adult Nematocera, of the families Chironomidae, Sciaridae (mainly these two) and Ceratopogonidae, which are very common in the study location (in *Platypalpus* the majority of the prey are also small Nematocera, see STARK, 1994). Many small arthropods which could have been selected as prey due to their size were rejected. Some videos were made which show these rejections: Collembola (video 67), Acari (video 137), a small heteropteran (video 147) and Formicidae (videos 65, 93, 115 and 145).

A normal hunting scenario can be described the following way (video 32): when *A. lusitanica* detects a potential prey (through its movement), it starts to go faster, in small sprints, following the prey generally from behind. If the prey is found not be adequate, *A. lusitanica* will quickly cease to follow it – this choice seems to be made entirely relying on vision. If the prey is suitable, *A. lusitanica* will start by holding it with its fore and mid legs, manipulating it so as to facilitate a strike in the thorax’s lateral region (once a specimen was seen transporting an apterous



Fig. 4. Several aspects of the feeding biology of *Ariasella lusitanica*: a) a male holds its prey with its fore and mid legs while feeding; b) a male licks a pollen grain; c) a female shares what seems to be an exudation droplet with an ant; d) a male being carried away by an ant.

nematoceran by its abdomen, but it wasn't possible to determine where the first blow was made). Once, one *A. lusitanica* was observed lying upside-down on its abdomen while handling the prey, after capturing it. On some occasions this species was seen capturing prey in the teneral period, a more vulnerable phase given that the exoskeleton was not yet hardened and it was still not possible to fly (video 5).

While it's resting and feeding on a prey, *A. lusitanica* will sometimes hold it with the help of its fore and mid legs (Fig. 4a). Actually, while feeding, this species tends to rest, making the life of the photographer easier! While moving, they carry their prey using no more than mouthparts (video 4), like *Tachydromia* and *Tachypeza* (CHVÁLA, 1975, and TUOMIKOSKI, 1952). The time spent on feeding is variable, and periods from 8 minutes (a female) to more than one hour (a male) were recorded, but it was not possible to determine if the specimen really was feeding during all that time or just carrying the prey. While feeding, *A. lusitanica* will pierce on different parts of the prey's body (videos 34, 35, 36 and 44).

It should be noted that I've never observed, either on natural conditions or in a small tube,

individuals of this species preying on each other, something which has been observed in other Tachydromiinae like *Platypalpus* and *Chersodromia* (Chvála, 1975), and *Crossopalpus* sp. (my observation) in which an individual attacked and was feeding on another of the same species (all of this inside a vial). Tuomikoski (1952) refers a previous study in which *Tachydromia* would prey on individuals of the same species, and he himself observed a *Tachydromia* species attacking another species of the same genus.

Besides predation, this species completes its alimentary regime with other non-animal substances. On at least one occasion I recorded a specimen sucking what seemed to be an exudation droplet, which it shared with an ant (*Temnothorax* sp.) (Fig. 4c). Sharing wasn't pacific, however, and the fly showed itself disturbed with the hymenopteran's presence, backing away momentarily for several times (video 65). Sometimes I recorded specimens licking pollen grains found on the ground, for several seconds at a time (video 74; fig. 4b). In the video it's possible to see how *A. lusitanica* uses the fore leg's tarsi to taste the grains. It is also frequent to see *A. lusitanica* licking various types of surface

such as dead leaves, soil, rocks, a garden hose and others, maybe searching for humidity. In these situations they will also use the fore leg's tarsi to taste the surface. Soil licking is also seen at times when pine tree pollen is widely dispersed, but given this pollen's grain size is very small it could conceivably be feeding on it (intentionally or not) when it's licking the ground (videos 46, 121 and 152). They were never observed feeding on flowers, but it's probably best not to rule out this hypothesis, since other Tachydromiinae were already seen occasionally feeding on flowers (TUOMIKOSKI, 1952), and I've also seen *Platypalpus* on flowers.

Intraspecific cleptoparasitism is frequently observed in this species. On the great majority of the cases a female steals a male's prey, when it comes across one, and only once (at least) have two males been seen fighting for a prey (videos 40, 41, 42 and 43). I've never recorded a female stealing a prey from another female, neither a male stealing from a female, but there was an instance of a male recovering a prey stolen by a female (see videos 83, depicting the stealing, and 84, when the male recovers the prey after a failed mating attempt), and another of a male on top of a female trying to take the female's prey (however, it's not possible to know if the male was trying to regain or just steal the prey, or how the struggle ended, since both disappeared under leaf litter, see video 156). The cleptoparasitism observed in this species seems to have some connection to sexual behaviour (see following section).

On no occasion have I seen *A. lusitanica* being captured by a predator, but once I observed a *Lasius* sp. ant carrying a still living male specimen (Fig. 4d). These flies are fast runners, so the possibility that this specimen was already injured or dying when the ant found it should not be excluded.

Intraspecific interactions

Interactions between *A. lusitanica* specimens in the majority of cases seem to have some connection to sexual behaviour, so I've opted to divide this section in three subsections to better convey the nature of the interactions between the different sexes, so as to make the text more comprehensible.

a) Male/female interaction

An usual encounter between male and female can be described as follows: when a female and male encounter each other (it didn't seem to me that any of the sexes looks for the other), the female starts to arch its legs, keeping the body close to the ground, raises the abdomen and oscillates laterally, all of this while approaching the male. Simultaneously, from the moment it sees the female, the male stretches the abdomen and starts waving it vertically (sometimes frenetically), while turning sideways to the female (similar to the defensive behaviour mentioned in a previous section). When the female gets within 2 to 3 mm of the male, the latter stops waving the abdomen, and keeps it stretched into the air (during all of this, the genitalia is slightly directed towards the female, maybe releasing pheromones?) (Fig. 5a). The female then tries to grab the male (using mainly the fore legs) by its abdomen, legs and thorax while the male, while keeping the abdomen raised tries to escape in the opposite direction (Fig. 5b). Then, in most cases, the female's interest is so strong that the male stops fleeing.

From this point on, their behaviour takes different paths whether the male is, or not, in possession of prey (I've never encountered the opposite, in which a female with a prey encounters the male).

In the case that the male is in possession of a prey, the female tries to take it away, the male fighting back with its fore and mid legs from the side in which the female is (Fig. 5c). When the female gets the prey, from below, and as soon as the prey is in possession of it, the male jumps on its back beginning the mating attempt. At this time, the male intertwines its fore legs with the female's fore legs, place the mid legs on the female's waist and tries to connect the genitalia (Fig. 5d). The male starts "beating" its club-shaped wings rhythmically, placing their distal extremity at the female's eye level (the reason for this is not clear, see Fig. 5e), while the female tries, with its hind legs, to expel the male. From this point onwards, and in most cases, mating is unsuccessful and the pair separate after a few seconds (see videos 103, 146, 153, 155 and 158). When they separate it's usually the female that maintains the prey, but I've also recorded cases in which the male fought to get it back, in one case with success (see video 84). After separation, the male will usually seem disoriented, and will

seemingly rub its body and legs against the ground, soon returning to normal activity.

On this species the males have, on their fore tibiae, long dorsal hairs with curled tips, lacking on the female (GROOTAERT *et al.*, 2009). Their function is not known, and during the observations no concrete evidence could be ascertained, but since the couple intertwine their fore legs at certain point during the mating ritual, this could suggest a possible role for these hairs. It could be interesting to compare the mating ritual of this species to similar ones in which the males don't have these more developed hairs, like *Pieltainia iberica* and *Ariasella semiaptera* Gil, 1923.

When the male is not in possession of a prey, the female seems to be looking for a prey, and they end up entangling. Then, they either separate quickly without the male having jump on the female's back, or with the female apparently becoming aggressive towards the male, but , even so, they separate shortly after (to see these two situations see videos 57, 116, 117, 130 and 151). In video 128 I recorded a slightly different variation: as the female oscillates while approaching the male, the latter doesn't pull back, readily and aggressively jumping on the female's back (they rolled out of view among the leaf litter, so the result is not known). There were also some instances of both specimens losing interest quickly without making physical contact (videos 129 and 143). Videos 163 and 165 show aggressive attitudes from the male directed to the female: in 163 the male performs an "attack simulation", causing the female to flee. In 165, as the male gets near the female, it waves the abdomen vertically, slightly, and then jumps on it grabbing the female a few times until it goes away.

When these situations (when a male is or not in possession of a prey) are compared, it seems that the presence of a prey somehow helps the male mount the female (maybe it helps to attract the female and then keep it distracted when the male goes on top). The records of a female being mounted when a prey is present were much more numerous, when we count the instances when physical contact happened (Table 1).

Comparing these situations (and using only instances when some sort of physical contact happened as a means of comparing situations reliably): a) when prey is present, 13 out of 16 cases resulted in the male mounting the female; on the other 3 cases, the male either managed to

Table 1: Summary of the results of interactions between males and females when a male is carrying a prey item or not (only considered the cases when physical contact occurred)

Physical contact between male and female	Male with prey	Male without prey
Female mounted	13	1
Female not mounted	3	7

escape (in 2 cases) or both of them disappeared, with no way of knowing whether copula occurred; b) when prey is absent, only 1 in 8 cases of physical contact resulted in the male mounting the female, and both seemed more aggressive than normal (video 128). In this analysis I disregarded cases when I found a copula already in progress.

Epigamic behaviour in Tachydromiinae generally occurs without simultaneous feeding (CHVÁLA, 1975). *A. lusitanica* is one of the exceptions to the rule since the presence of prey during this behaviour seems to have an important role and is very frequent.

In all mating attempts that I've seen, only twice have I observed mating beginning. In both cases the male was in possession of a prey, which was taken away from it in the manner described above. In one of the cases I managed to follow the couple's activity for some 25 minutes after mating began. After 20 minutes from the beginning, the female stops feeding on the prey (video 160). After the 25 minutes I lost sight of the couple among the vegetation, and after 15 minutes I encountered again a couple mating, so I cannot be sure if it's the same one. At this time, the female was carrying a new prey item. From the time the couple reappeared (considering it was the same couple, which can't at all be confirmed) until mating ended 1 hour and 10 minutes elapsed. During this time, the couple was disturbed by my presence when I tried to film and photograph, but when they separated it didn't seem that I had an influence in the outcome, because when that happened I was watching them from a distance for several minutes.

Adding to these two cases when I watched mating begin, I encountered a few couples already in copula. The male stands atop the females back, and it's the female that moves around carrying the male with it (video 160). The male keeps very stiff during the whole process, keeping its mid legs on the female's thorax, the fore and hind legs suspended in the air, and the wings in the natural

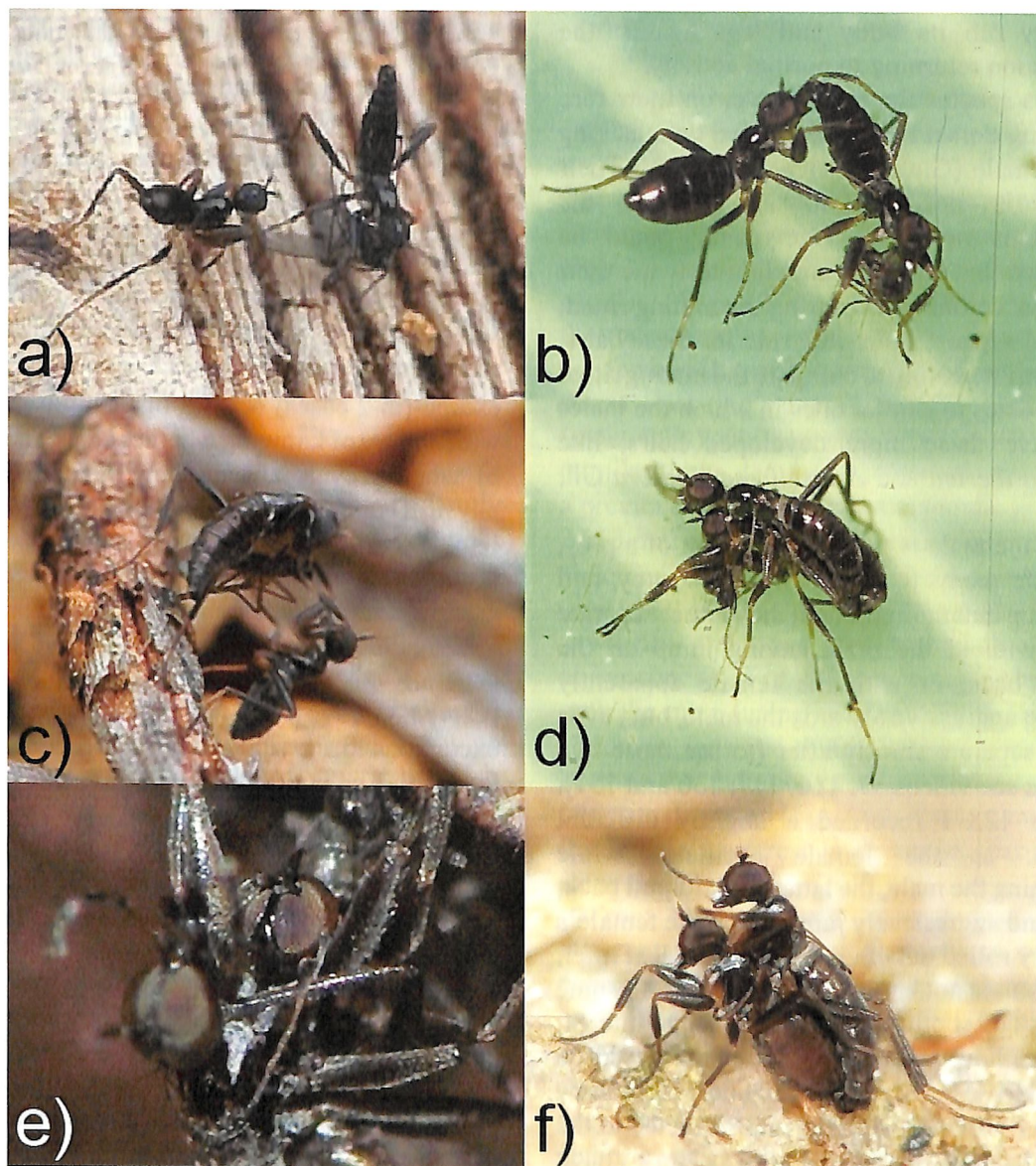


Fig. 5. Several aspects of the sexual interaction between males and females in *Ariasella lusitanica*: a) a female approaching a male, the latter holding a prey, and both performing ritualized postures; b) a female grabs the male while the latter tries to escape; c) the moment when the prey is transferred from male to female; d) the male is on top of the female (already with the prey), beating its wings, and both intertwining their fore legs; e) detail of the position of a male wing close to the female's eye; f) normal posture during copula with the male on top of the female. Images 5a and 5c are video captures.

resting position (Fig. 5f). The only sign of movement from the male is a slight movement of the hind legs and the fore legs' tarsi, which occur from time to time. On some occasions the female shakes frenetically, and uses the hind legs (and once with one of the fore legs), maybe to get rid of the male (videos 6, 7, 8 and 162). In 2008 a couple was encountered copulating tail-to-tail, each one facing opposite sides, but this may have happened due to disturbance, or being ready to separate, which happened some minutes later. During this copula, the male stood still, being dragged by the

female (videos 1, 2 and 3). In video 3, it's possible to see the female trying to separate itself from the male using its hind legs. In 2009 I found a couple copulating with the male above the female (video 126), which hid under the vegetation when scared by my presence. When they re-emerged they were mating tail-to-tail, probably because they were disturbed.

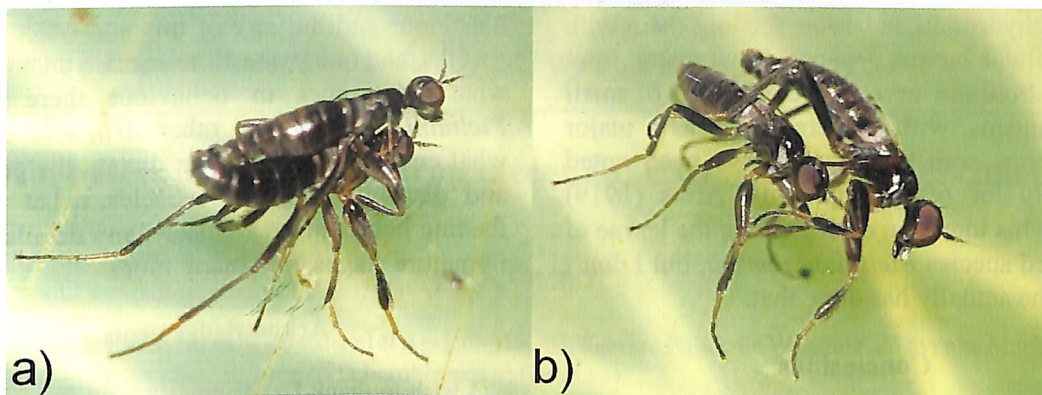


Fig. 6. Mating attempts between two males: a) the top male tries to grab the genitalia of the one below, at the same time as it beats its wings; note that the fore legs do not intertwine; b) the top male abandoning the mating attempt, while the one below remains very stiff.

b) Male/male interaction

It's very frequent to see a male mounting another in this species, and this is the behaviour most frequently observed when two males meet. The majority of the encounters I recorded occurred when neither was feeding on a prey. On those occasions the males, when facing each other, would wave their abdomens vertically before one of them went on top of the other (from the front, as in videos 113 and 115, or going around the other, from behind, as in 119). From the moment a male is on top of the other it will try to grab the other male's genitalia with its own, doing as it would do with a female, including the same wing movements (videos 115 and 149), but apparently without intertwining the fore legs; the male below will stand stiff (Fig. 6a). A few seconds later, the males split (Fig. 6b).

Sometimes it's possible to see males (two or more) jumping on top of each other in succession (videos 69, 112, 114 and 166). I've also recorded cases in which the behaviour of two males mirrors the approaching behaviour observed when a male and a female are involved, with one of the males performing the typical female behaviour – as one can see in videos 149 and 150, the approaching male oscillates laterally while raising the abdomen (waving it vertically) and keeping the body close to the ground. At the same time, the waiting male faces sideways and waves the abdomen vertically. After that, the approaching male jumps on top of the other beginning a mating attempt, which ends a few moments later.

On one occasion it was possible to see the behaviour performed by two males which met when one of them was feeding on a prey. The feeding male was resting when the other approached. As the feeding male noticed the

approaching male, it started to wave its abdomen vertically; the approaching male, when near the other, starts to laterally oscillate in a vigorous manner, with the body close to the ground, as if preparing an attack, which was then made with a jump towards the other male. Both then got into a dispute over the prey which lasted for some seconds, after which they separated, with one of the males keeping the prey (it was not possible to confirm whether the approaching male was successful in stealing the prey; see videos 40, 41, 42 and 43).

c) Female/female interaction:

When two females meet we can see them wave the abdomen vertically and performing small chases, some of them resulting in attacks in which they entangle, but quickly separate. Never in these female interactions have I seen the lateral oscillation they do when they encounter males or do the attack simulations mentioned in a previous section (videos 54, 71, 88 and 89). In all occasions in which I saw females interacting they were never feeding on a prey.

Reproduction

Unfortunately I never recorded a female ovipositing. This is something difficult to do due to the complex nature of the substrate in which this species lives, with a great quantity of leaf litter, twigs, plants and other objects under which specimens can hide. Oviposition is probably done on humid soil where larvae can probably develop feeding on other small organisms, as CHVÁLA (1975) proposes for the majority of Tachydromiinae. CUMMING & COOPER (1993) have done successful feeding experiments with

some Tachydromiinae larvae, feeding them with Drosophilidae larvae, proposing that many if not all tachydromiine larvae were predators of small soil organisms, with Diptera larvae as a major food source, something which has been noted previously for other empidoidea. Arias (1919) mentions his intention of describing the larvae of the related species *Pieltainia iberica*, but I don't know if he actually has done that.

Conclusions

Until now practically nothing was known about the behaviour of the genus *Ariasella*, and I knew of only a brief description of the behaviour of the related species *Pieltainia iberica*. The recent discovery of *Ariasella lusitanica* made it possible for me to follow more closely the behaviour of this fascinating species, making some aspects of its life known.

Like in *P. iberica*, this is a species in which adults appear very early in the year, staying active for only about 3 months. They're especially numerous in shadowy and humid places, among leaf litter, where they're predaceous on small adult nematocerans. They're rarer in drier environments, but they were observed in heathland and on rural pathways. Besides being a predator, this species was seen licking pollen and, on one occasion, what seemed to be an exudation drop. When they feel threatened they will wave their abdomens up and down (more evidently in males). Both sexes perform a curious behaviour in which they seem to attack objects, even doing this in the seemingly absence on any stimuli (a behaviour that seems to resemble another done by some species of *Platypalpus*).

Intraspecific cleptoparasitism is very common and seems to be in most of the cases associated with sexual behaviour, since I recorded numerous cases in which the female would take away a male's prey, who would in turn quickly climb onto the back of the female and start copulating. The presence of prey seems to influence the success of the sexual encounter: males mount females more frequently when a prey is present, and in the only situations in which I observed copula actually taking place a prey item was present. The study of several mating attempts showed some interesting stereotypical display movements. It was also seen with some frequency males attempting to mate with other males, attempts which are short-lived.

There is obviously still much to learn about the

behaviour and biology of this and other related species, and many questions remain unanswered: what differences in behaviour there are to *Pieltainia iberica* and other *Ariasella* species, what environmental factors dictate the presence and distribution of the species, what are its feeding habits more precisely, any details on the immature stages, and many more.

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References

- ARIAS J., 1919. - Descripción preliminar de un nuevo Émpido de España. *Boletín de la Real Sociedad Española de Historia Natural*, 1919: 479-481.
- CHVÁLA M., 1975. - The Tachydromiinae (Dipt. Empidoidea) of Fennoscandia and Denmark. *Fauna Entomologica Scandinavica*, 3: 1-336.
- CUMMING J.M. & COOPER B.E., 1993. - Techniques for obtaining adult-associated immature stages of predacious tachydromiine flies (Diptera: Empidoidea), with implications for rearing and biocontrol. *Entomological News*, 104: 93-101.
- GROOTAERT P. & SHAMSHEV I., 2008. - Notes on the halobiont genus *Chersodromia* (Diptera: Hybotidae) from Tunisia with the description of a new brachypterous species and notes on brachyptery in empidoidea. *Bulletin S.R.B.E./K.B.V.E.* 144: 57-63.
- GROOTAERT P., SHAMSHEV I. & R. ANDRADE, 2009. - Description of a new brachypterous *Ariasella* Gil (Diptera, Hybotidae, Tachydromiinae) from Portugal. *Bulletin de la Société royale belge d'Entomologie*. 145: 45-48.
- <http://www.youtube.com/user/ariasellaportugal>
- STARK A., 1994. - Zum Beutespektrum und Jagdverhalten von Fliegen der Gattung *Platypalpus* (Empidoidea, Hybotidae). *Studia Dipterologica*, 1: 49-74.
- TUOMIKOSKI R., 1952. - Über die Nahrung der Empididen-Imagines (Dipt.) in Finnland. *Annales Entomologici Fennici*, 18(4): 170-181.
- WUELLNER C. T., PORTER S. D. & GILBERT L. E., 2002. - Ecdysis, mating, and grooming behavior of the parasitoid fly *Pseudacteon curvatus* (Diptera: Phoridae). *Florida Entomologist*, 85: 563-566.