Abdominal percussion and ventral scutum in male *Euophrys frontalis* (Araneae: Salticidae)

Sound production during courtship by the male jumping spider *Euophrys frontalis* is caused by beating his abdomen on the substrate, and not - as described in the literature - by his front legs. The male abdomen suits this purpose nicely, as it is ventrally sclerotized and almost hairless.

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Introduction

The courtship of *Euophrys frontalis* has been described by Bristowe (1929, 1958), and this description is often referred to (e.g. Foelix 1992, Jackson 1982, Preston-Mafham & Preston-Mafham 1984). During courtship the male performs a seemingly endless series of identical actions, each lasting approximately one second, in which his extended forelegs are lowered slowly from an elevated position to the substrate and then abruptly raised, accompanied by a faint sound - audible to the human ear - and a jerky movement of his body. Bristowe (1958) attributes this sound to "the tarsal claws" as they "hit the ground before their upward ascent is started".

Video recordings

Recently I recorded the courtship of several males on video. When playing the tape at normal speed it is difficult to determine what is happening, but when the tape is studied image by image the jerk of the body appears to consist of a very fast circular movement (figure 1), lasting about 0.15 second. From the images it becomes clear that the sound is caused by the collision of the abdomen with the substrate. Under the microscope the ventral side of the male abdomen shows special morphological adaptations: the skin in the region between epigastric furrow and spinnerets is sclerotized with a microstructure of transverse "hills and valleys" and has only very few hairs, which are thin and flexible (figure 2, 3). Such a hard sclerotized plate on the abdomen is called a scutum. The hitting of the substrate is combined with a forward motion of the abdomen. Perhaps in this way the male tries to avoid abrasion of the few hairs on the scutum and obstruction by the numerous lateral hairs - all those hairs are pointing towards the rear end of the body.

Drumming or waving?

The tarsi of the forelegs do not seem to be equipped particularly well for percussion. The ventral side which touches the substrate is furnished with soft white hairs and the tip below the claws bears the claw tuft. The video recordings show that these tarsi touch the substrate in many sequences of up-down movements, but - unlike the abdomen - not in all. The movement of the forelegs is probably merely a visual signal: the white tips on the dark forelegs make the performance eye-catching.

Figure 1. Male *Euophrys frontalis* beating the substrate with the abdomen, which occurs more or less synchronous with the ascent of the forelegs. The thick arrows indicate a rapid movement, the thin arrow a slow movement.
Mannetje van Euophrys frontalis *trommelt met het achterlijf op de ondergrond en heft hierbij min of meer synchroon de voorpoten. De dikke pijlen geven een snelle, de dunne pijl een langzame beweging aan.*

Substrate

One wonders whether the male or the female chooses substrates with better resonance properties during courtship. At first sight the male seems to be rather indiscriminate in this respect. When a female is walking away he follows her, often courting incessantly whatever the substrate: on sand, on dry leaves, on wet leaves, etcetera. Another question is whether the female reacts differently to air vibrations (sound) than to substrate vibrations, which reach her directly when in close proximity of the male. Substrate-borne vibrations are

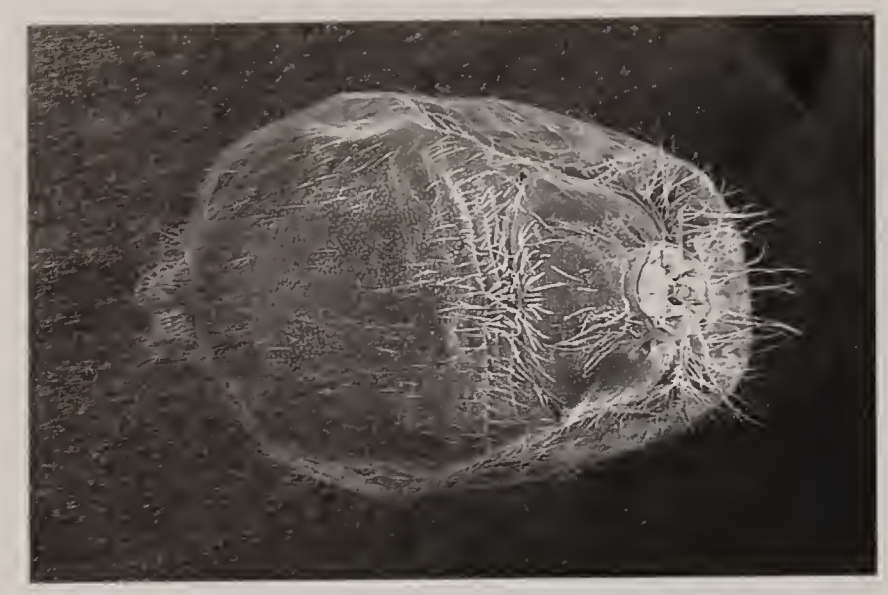

Figure 2. Ventral side of male abdomen of *Euophrys frontalis*.
Onderzijde van achterlijf van mannetje Euophrys frontalis.

thought to be more important in spider communication than airborne ones, although the latter do play a role (Barth 1982).

There are several other spider species in which the male beats the substrate with his abdomen during courtship, e.g. the lycosids *Hygrolycosa rubrofasciata* and *Pardosa sphagnicola*. The former can occur in for instance dead leaves of purple moor-grass, *Molinia caerulea*, as recorded on video by the author. In these two species the ventral side of the abdomen is furnished with short teeth and some short hairs, but long hairs are absent (Kronestedt 1996).

Presence/absence of scuta in related species

Euophrys frontalis belongs to a group of closely related species with in many cases almost identical genitalia. The females of some species can hardly, or not at all, be told apart. The males differ more by colour patterns used in courtship than by genitalia. Logunov (1997) redefined the genus *Euophrys* to include only this group of closely related, mostly palearctic species. He includes 29 species in *Euophrys* s. str., of which *E. frontalis* is the type species. The many descriptions of *E. frontalis* (e.g. Locket & Millidge 1951; Metzner 1999; Tullgren 1944; Zabka 1997) do not mention the male abdominal ventral scutum. Only Logunov et al. (1993) and Logunov (1997) emphasize its value for identification, without any remark on ethology. The scutum is absent in ten related species, among which the only other species of this group occurring in The Netherlands and Great Britain, *E. herbigrada*. Presence or absence of the scutum in the remaining species is not mentioned in publications so far. The male of another Northwest-European species, *Talavera petrensis* (formerly in *Euophrys*), also has a ventral abdominal scutum.

Recommending Locomotics

The great arachnologist Eugène Simon (1848-1924) was aware of the importance of frontal colour patterns in Salticidae. He always paid attention to these characters as well as to genitalia, for example in his treatment of the Salticidae in "Les arachnides de France" (Simon 1937). Twelve of the 29 species placed by Logunov (1997) in *Euophrys* s. str. were described by Simon. By considering also the frontal colour patterns, he described easy and reliable differences, for example between *E. frontalis* and *E. herbigrada*. These characters had been forgotten in more recent literature focusing on genitalia, as explained by Merrett (1995).

The conclusion of the present paper could be a general recommendation to taxonomists to take more account of characters linked with ethological species barriers, of which the ventral scutum in *E. frontalis* is an example - although this is perhaps nothing new.

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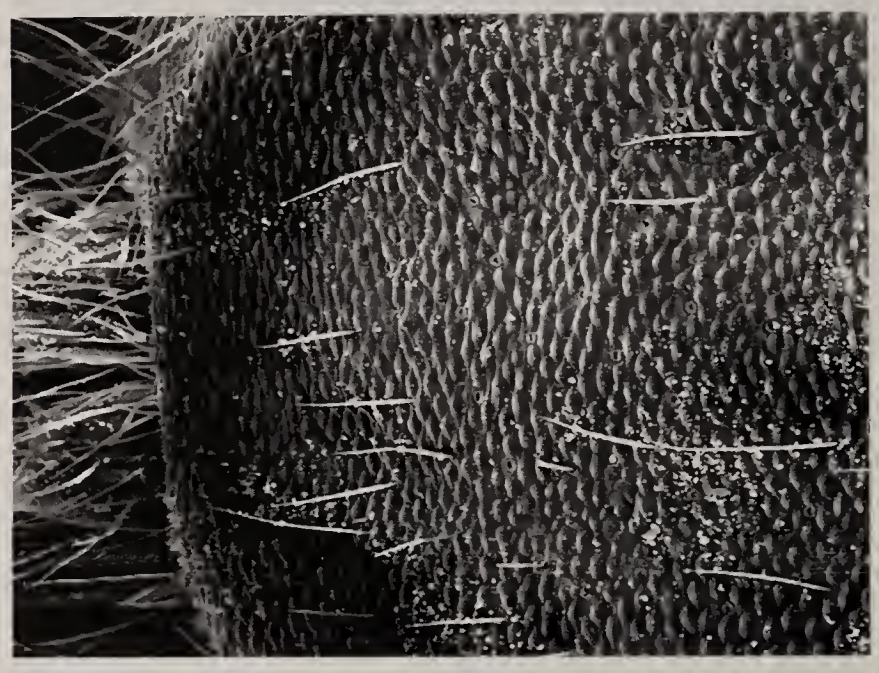

Figure 3. Male abdomen of *Euophrys frontalis* ventrally at high magnification, showing a microstructure of interconnected transverse furrows.
Onderzijde van het achterlijf van mannetje Euophrys frontalis *bij sterke vergroting, met de microsculptuur van onderling verbonden dwarsgroeven.*

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Samenvatting

Over het trommelen met het achterlijf door mannetjes van *Euophrys frontalis* (Araneae: Salticidae) Het mannetje van de springspin *Euophrys frontalis* heeft een opvallende balts, die al eerder uit de literatuur bekend was. Meest in het oog springend zijn de ritmisch op en neer bewegende donkere voorpoten met hun contrasterende witte tarsi. Op het moment dat deze poten zeer snel omhoog bewegen wordt een zwak geluid gemaakt - onder gunstige omstandigheden ook hoorbaar voor de mens. Tot op heden werd geloofd dat dit geluid door trommelen met de voorpoten werd geproduceerd. Uit recente video-opnamen blijkt echter dat het achterlijf met korte slagen op de ondergrond trommelt. Hiertoe blijkt het achterlijf aan de onderzijde gesclerotiseerd en vrijwel kaal. Op deze plek hebben de mannetjes van een paar zeer verwante soorten (*E. herbigrada* en *E. flavoatra*) een weke behaarde huid. Op basis van de genitalia zijn deze soorten vrijwel niet te onderscheiden.

Figure 4. Male and female *Euophrys frontalis* during courtship.
Mannetje en vrouwtje Euophrys frontalis *tijdens de balts.* Tekening: Aart Noordam