

A NEW SPECIES OF *ZWICKNIA* MURÁNYI, 2014 FROM SPAIN (PLECOPTERA: CAPNIIDAE)

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ABSTRACT

A new species, *Zwicknia avilensis* **sp. n.**, from Spain is described and illustrated from male and female adults and last instar larvae. Morphological affinities of this new species are also discussed and a key to adult *Zwicknia* Murányi, 2014 from Western and Southern Europe is proposed. From the morphological point of view *Zwicknia avilensis* **sp. n.** clearly differs from all other known species or subspecies of the *Zwicknia* genus.

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Keywords: *Zwicknia avilensis* **sp. n.**, Spain, alpha taxonomy, identification key.

RESUMEN

Una nueva especie de *Zwicknia* Murányi, 2014 de España (Plecoptera: Capniidae)

Se describe e ilustra una nueva especie, *Zwicknia avilensis* **sp. n.**, de España a partir de machos y hembras adultos y de larvas del último estadio. También se discuten las afinidades morfológicas de esta nueva especie y se propone una clave para los adultos de *Zwicknia* de Europa occidental y meridional. Desde el punto de vista morfológico, *Zwicknia avilensis* **sp. n.** difiere claramente de todas las demás especies o subspecies conocidas del género *Zwicknia*.

Palabras clave: *Zwicknia avilensis* **n. sp.**, España, taxonomía alfa, clave de identificación.

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Introduction

The establishment of the genus *Zwicknia* Murányi, 2014 and the partial revision of the genus *Capnia* Pictet, 1841 by Murányi *et al.* (2014) have induced several important changes in the taxonomy of the Capniidae, thus rendering necessary to revise the material collected in Spain under these labels. In this region, the family Capniidae is represented by the four genera *Capnia*, *Capnioneura* Ris, 1905, *Capnopsis*

Morton, 1896 and *Zwicknia*. Whereas the status of *Capnioneura* (six species, *Capnioneura petitpierreae* Aubert, 1961, *C. brachyptera* Despax, 1932b, *C. libera* (Navás, 1909), *C. mitis* Despax, 1932a, *C. gelesae* Berthélemy & Baena, 1984, *C. narcea* Vinçon & Sánchez-Ortega, 2002) and *Capnopsis* (one species, *C. schilleri* (Rostock, 1892)) remain unchanged in Spain (Tierno de Figueroa *et al.*, 2003, 2014, 2018), the former genus *Capnia* is now subdivided into three different taxa: a genus *Capnia sensu stricto*, *sensu*

Murányi, 2014, which has as its sole representative the widely distributed transpalearctic *Capnia nigra* (Pictet, 1833), then a genus *Capnia sensu lato*, *sensu* Murányi, 2014, which includes only the species *Capnia vidua* Klapálek, 1904 (Luzón-Ortega *et al.*, 2013; Tierno de Figueroa *et al.*, 2014), and finally, the genus *Zwicknia*, which now replaces the former species complex *Capnia bifrons* (Newman, 1838). Upon examination, it turned out that specimens of *Zwicknia* from the Province of Ávila, Spain, that had previously (González del Tánago, 1984) been identified as the now obsolete taxon *Capnia bifrons*, could not be assigned to one of the already known twelve species or subspecies of *Zwicknia* (DeWalt *et al.*, 2021) and gave rise therefore to the suspicion that they corresponded to an unknown taxon. Fresh material collected from the same sampling station in winter 2020 and spring 2021 by the second author have confirmed these initial findings, enabling the description of this new species in the present contribution.

Material and methods

COLLECTING. Adults of *Zwicknia* were collected by using a “Japanese umbrella” (beating sheet). Nymphs of *Zwicknia*, together with other aquatic macroinvertebrates, were collected by using a hand net and by removing the substratum (González del Tánago, 1984). The older material studied in this contribution had been collected by Dr. Marta González del Tánago in 1981. These specimens were initially stored in the private collection of Dr. Marta González del Tánago, and later, in the 1990s, transferred to the A. Sánchez-Ortega collection in the Department of Zoology (formerly Department of Animal Biology and Ecology) of the University of Granada (Spain). Additional adult specimens have been collected by the second author in winter 2020 and spring 2021. The material is preserved in ethanol.

TERMINOLOGY AND ABBREVIATIONS. Terminology for adults follows that of Murányi *et al.* (2014). The wing venation terminology used within this paper follows Béthoux (2005) and Béthoux *et al.* (2015). The following abbreviations are used: m = adult males; f = adult females; Lm = male larvae; Lf = female larvae; MZL = collections of the Zoological Museum of Lausanne, Switzerland; GVC = collection of G. Vinçon; RC = collection of J.-P.G. Reding; SOC = collection of Sánchez-Ortega, Department of Zoology, University of Granada, Spain.

MORPHOLOGY AND DEPOSITORIES. For the identification of adults and larvae, Murányi *et al.* (2014), Boumans & Murányi (2014), Reding *et al.* (2016), Reding (2020, 2021) and Vinçon & Reding (2018) references were used. Adults of the following six

species from Western and Southern Europe were examined for comparison: *Zwicknia acuta* Murányi & Orci, 2014, *Z. bifrons*, *Z. gattolliati* Vinçon & Reding, 2018, *Z. ledoarei* Reding, Launay, Ruffoni, Vinçon & Boumans, 2016, *Z. rupprechti* Murányi, Orci & Gamboa, 2014 and *Z. westermanni* Boumans & Murányi, 2014. Illustrations of the specimens were produced by the first author with the help of a Nikon E5400 camera attached to a Leica S8-APO stereomicroscope. The photograph of the sampling station was taken by second author. Holotype and paratypes are deposited in the Zoological Museum of Lausanne, Switzerland.

Results

Zwicknia avilensis sp. n.

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Figs. 1–13

Capnia bifrons (Newman, 1838) – González del Tánago, 1984: 53.

TYPE MATERIAL. **Holotype male:** SPAIN, Ávila Province (05143), Sierra de la Serrota, Arroyo de Canto Moreno, Muñotello, Duero basin; 40°33'37.13" N, 5° 01'29.02" E, 1129 m a.s.l., 26.XII.2020, leg. Isabel Pardo, deposited in the MZL (catalogue number: GBIFCH00830015).

Paratypes: same locality (Fig. 56), same date, 1m, 1f, leg. Isabel Pardo, deposited in the MZL (catalogue numbers: GBIFCH00830016 (male); GBIFCH00830017 (female)).

Additional specimens are held in the collections of SOC, GVC and RC: **SPAIN:** Ávila Province (05143), Sierra de la Serrota, Arroyo de Canto Moreno, Muñotello, Duero basin; 40°33'37.13" N, 5° 01'29.02" E, 1129 m; 15.III.1981, 3m, 3f (leg. Marta González del Tánago; GVC); 15.III.1981, 3m, 2f; 6Lm, 6Lf (leg. Marta González del Tánago; SOC); 02.IV.2021, 2f (leg. Isabel Pardo; 1f, RC; 1f, MZL used for molecular studies (catalogue number: GBIFCH00829872)).

MORPHOLOGICAL DIAGNOSIS

Male strongly micropterous; female macropterous. Process of male tergite 9 projecting headward (Figs. 1–4, 7–8). Main epiproct sclerite slender, smoothly truncated and with a slightly blunted tip in lateral view (Figs. 2–3). Main epiproct sclerite with a small “hunchback” dorsally in its middle section (Figs. 3–4).

DESCRIPTION

Head, thorax, appendages and basal segments of the abdomen as typical for the genus. Male strongly micropterous (Fig. 9). Female macropterous. Body length: holotype 5.0 mm, male paratypes 4.9–7.5 mm, female paratypes 9.0–10.1 mm; forewing length of males: holotype 1.1 mm, male paratypes 0.5–1.8 mm, female paratypes 10.0–11.0 mm.



Figs. 1–6.— *Zwicknia avilensis* **sp. n.**, male. **1**, epiproct and process on tergite 9, lateral view; **2**, epiproct and process on tergite 9, lateral view; **3**, epiproct and process on tergite 9, lateral view; **4**, epiproct and process on tergite 9, lateral view («hunchback» marked by arrow); **5**, process on tergite 9, plain dorsal view; **6**, process on tergite 9, caudal view.

Figs. 1–6.— *Zwicknia avilensis* **sp. n.**, macho. **1**, epiprocto y proceso del 9º terguito, vista lateral; **2**, epiprocto y proceso del 9º terguito, vista lateral; **3**, epiprocto y proceso del 9º terguito, vista lateral; **4**, epiprocto y proceso del 9º terguito, vista lateral («joroba» marcada con flecha); **5**, proceso del 9º terguito, vista dorsal; **6**, proceso del 9º terguito, vista caudal.

Males (Figs. 1–10). Process of tergite 9 highly elevated and projecting headward, in lateral (Figs. 1–4) and dorsal (Figs. 7–8) views. In caudal view, process of tergite 9 with a wide base and a dome-shaped apex (Figs. 6–8). In lateral view, the main epiproct sclerite is long and slender, with a slightly blunted tip, neither upcurved nor downcurved (Figs. 2–3). Dorsal part of apex of epiproct smoothly truncated, in lateral view (Figs. 1–4); ventral part straight. Main epiproct sclerite with a small “hunchback” in its middle section (Figs. 3–4,

arrow). Membranous part of the apex of the main epiproct sclerite very long, in lateral view (Figs. 3–4). In dorso-caudal view, the main epiproct sclerite is long and slender, with nearly parallel edges and not swollen medially (Figs. 5, 7–8). Apex of process on tergite 9 at least three times as wide as the tip of the main epiproct sclerite, in dorsal view (Figs. 7–8). Ventral vesicle very large and rounded, its size corresponding to one third of the width of the subgenital plate (Fig. 10). Subgenital plate heart-shaped, as typical for the genus (Fig. 10).

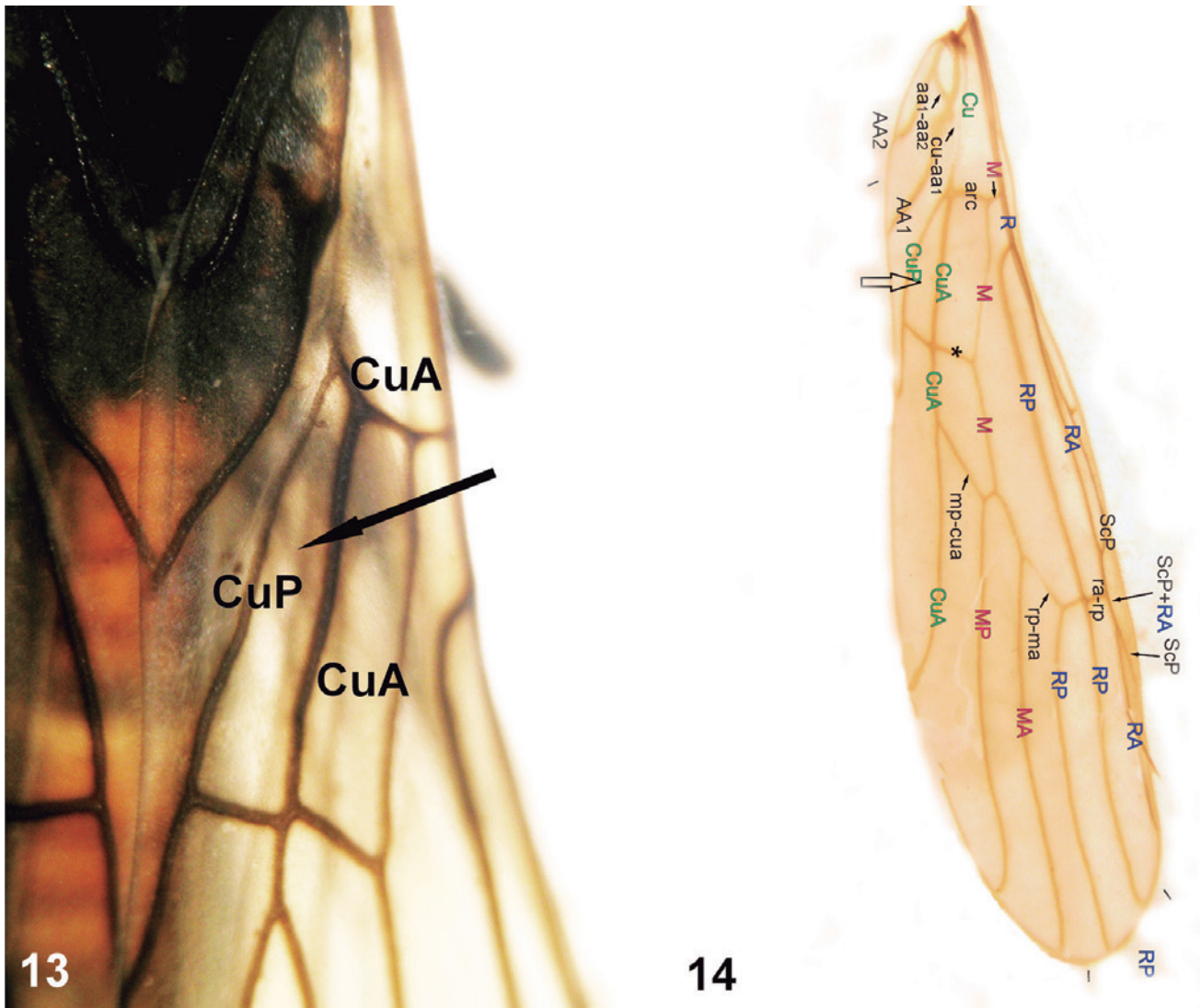


Figs. 7–12.— **7–10.** *Zwicknia avilensis* **sp. n.**, male. **7**, process on tergite 9, plain dorsal view; **8**, process on tergite 9, $\frac{3}{4}$ dorsal view; **9**, wings; **10**, ventral vesicle. **11–12.** *Zwicknia avilensis* **sp. n.**, female. **11**, femur of hindleg, lateral view; **12**, subgenital plate, ventral view.

Figs. 7–12.— **7–10.** *Zwicknia avilensis* **sp. n.**, macho. **7**, proceso del 9° terguito, vista dorsal, **8**, proceso del 9° terguito, $\frac{3}{4}$ vista dorsal; **9**, alas; **10**, vesícula ventral. **11–12.** *Zwicknia avilensis* **sp. n.**, hembra. **11**, fémur posterior, vista lateral; **12**, placa subgenital, vista ventral.

Females (Figs. 11–13). Wing venation as typical for the genus, with the first cell between CuA and CuP in anterior wings quadrangular in shape (Fig. 13; cf. Fig. 55; Aubert 1959: 26, fig. 22; Reding 2020: Vol. 4, fig. 17A20) and not triangular, as in *Capnia nigra* (Fig. 14) or *Capnia vidua*. Dorsal edge of femora and tibiae of all three legs with short bristles (Fig. 11). Posterior edge of female subgenital plate crescent-shaped (Fig. 12).

Larvae (Figs. 15–26). Male and female larvae of *Zwicknia avilensis* **sp. n.** bear very short and dense erect bristles of nearly equal length on head and pronotum (Figs. 15–17). Setation on basal segments of antennae very short and sparse. Abdominal tergites with very short, but compact bristles (Figs. 18–19). Row of bristles on abdominal tergites medially interrupted (Fig. 18). Lateral bristles on lower margin of abdominal tergites very short, not reaching the



Figs. 13–14.— **13.** *Zwicknia avilensis* **sp. n.**, female, wing venation of anterior wing. **14.** *Capnia nigra*, wing venation of anterior wing of adult female (annotations by Dr. Olivier Béthoux).

Figs. 13–14.— **13.** *Zwicknia avilensis* **sp. n.**, hembra, venación del ala anterior. **14.** *Capnia nigra*, venación del ala anterior de la hembra adulta (anotaciones del Dr. Olivier Béthoux).

adjacent tergite (Fig. 19). Dorsal margin of femur of posterior leg with an uncompacted row of both long and short setae, the longest measuring less than a third of the total width of the femur (Fig. 20). Dorsal edge of tibia of hindleg with a narrow row of long and fine setae in its distal part (Figs. 21–22). Micropterism clearly prefigured on male larvae (Fig. 23). In male larvae and nymphs, tergite 10, which prefigures the male epiproct and the process on tergite 9, with wide basis and blunt apex, in dorsal view (Fig. 24). In lateral view, tergite 10 is smoothly truncated in near mature larvae (Fig. 25) and more pointed in mature larvae (Fig. 26).

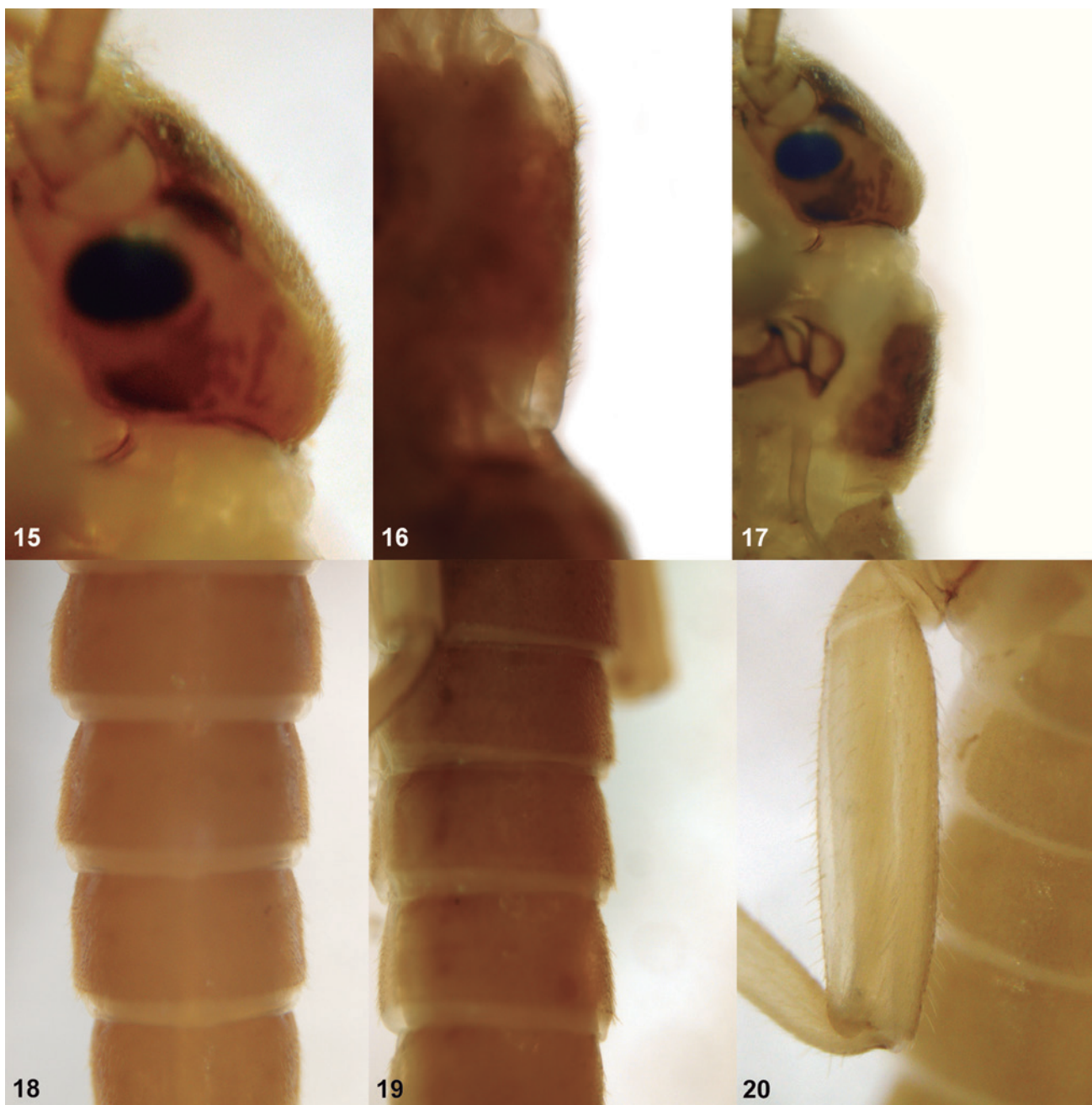
DERIVATIO NOMINIS

The species is named after the region where it was collected, namely the Ávila Province in Spain. The epithet is formed by adding the Latin toponymic suffix

–ensis to the place name Ávila and is to be treated as an epicene Latin adjective in the nominative case combined with *Zwicknia*.

MORPHOLOGICAL AFFINITIES

Adult males. From the morphological point of view, *Zwicknia avilensis* **sp. n.** stands rather isolated and differs from all other known species or subspecies of the genus *Zwicknia* from Western and Southern Europe by its headward pointing process of tergite 9 in lateral view (Figs. 1–4), whereas this process is raised perpendicularly in all other known species from these regions (Figs. 27–31), except for *Zwicknia rupprechti*, where it projects caudally (Fig. 32). In lateral view, the process on tergite 9 is highly elevated in *Zwicknia avilensis* **sp. n.** (Figs. 1–4), whereas it is low in *Zwicknia rupprechti* (Fig. 32) and *Z. ledoarei* (Fig. 31). In lateral view, the main epiproct sclerite



Figs. 15–20.— *Zwicknia avilensis* **sp. n.**, larva. **15**, bristles on head, lateral view; **16**, bristles on pronotum, lateral view; **17**, bristles on head and pronotum, lateral view; **18**, tergites, dorsal view; **19**, tergites, dorso-lateral view; **20**, dorsal edge of femur of hindleg, lateral view.

Figs. 15–20.— *Zwicknia avilensis* **sp. n.**, larva. **15**, cerdas de la cabeza, vista lateral; **16**, cerdas del pronoto, vista lateral; **17**, cerdas de la cabeza y pronoto, vista lateral; **18**, terguitos, vista dorsal; **19**, terguitos, vista dorso-lateral; **20**, borde dorsal del fémur posterior, vista lateral.

of *Zwicknia avilensis* **sp. n.** is slightly pointed (Figs. 1–4), but not acute as in *Z. acuta* (Fig. 28), *Z. westermanni* (Fig. 29) and *Zwicknia gattolliati* (Fig. 30). The epiproct tip of *Zwicknia avilensis* **sp. n.** is straight (Figs 1–4), not upcurved as in *Zwicknia gattolliati* (Fig. 30) or *Z. bifrons* (Fig. 27). In lateral (Figs. 1–4) and dorsal (Figs. 5, 7–8) views, the main epiproct sclerite of *Zwicknia avilensis* **sp. n.** is slender and narrow, whereas it is much thicker and larger in

Zwicknia bifrons (Fig. 27; Murányi *et al.*, 2014: 41, fig. 82) and *Z. rupprechtii* (Fig. 32). In lateral view, the membranous part of the apex of the main epiproct sclerite of *Zwicknia avilensis* **sp. n.** is very long (Figs. 3–4), much longer than the one of *Z. bifrons* (Fig. 27), *Z. acuta* (Fig. 28), *Z. rupprechtii* (Fig. 32; Murányi *et al.* 2014: figs. 106–109 and figs. 127–147), *Zwicknia westermanni* (Fig. 29), *Z. gattolliati* (Fig. 30) and *Z. ledoarei* (Fig. 31). In caudal view, the shape of



Figs. 21–26.— *Zwicknia avilensis* **sp. n.**, larva. **21**, dorsal edge of tibia of hindleg of male larva, lateral view; **22**, dorsal edge of tibia of hindleg of female larva, lateral view; **23**, micropterism prefigured on male larva, dorsal view; **24**, epiproct and process of tergite 9 of mature male larva, dorsal view; **25**, epiproct and process of tergite 9 of near mature male larva, lateral view; **26**, epiproct and process of tergite 9 of mature male larva, lateral view.

Figs. 21–26.— *Zwicknia avilensis* **sp. n.**, larva. **21**, borde dorsal de la tibia posterior de la larva macho, vista lateral; **22**, borde dorsal de la tibia posterior de la larva hembra, vista lateral; **23**, micropterismo prefigurado en la larva macho, vista dorsal; **24**, epiprocto y proceso del 9° terguito de la larva macho madura, vista dorsal; **25**, epiprocto y proceso del 9° terguito de la larva macho casi madura, vista lateral; **26**, epiprocto y proceso del 9° terguito de la larva macho madura, vista lateral.

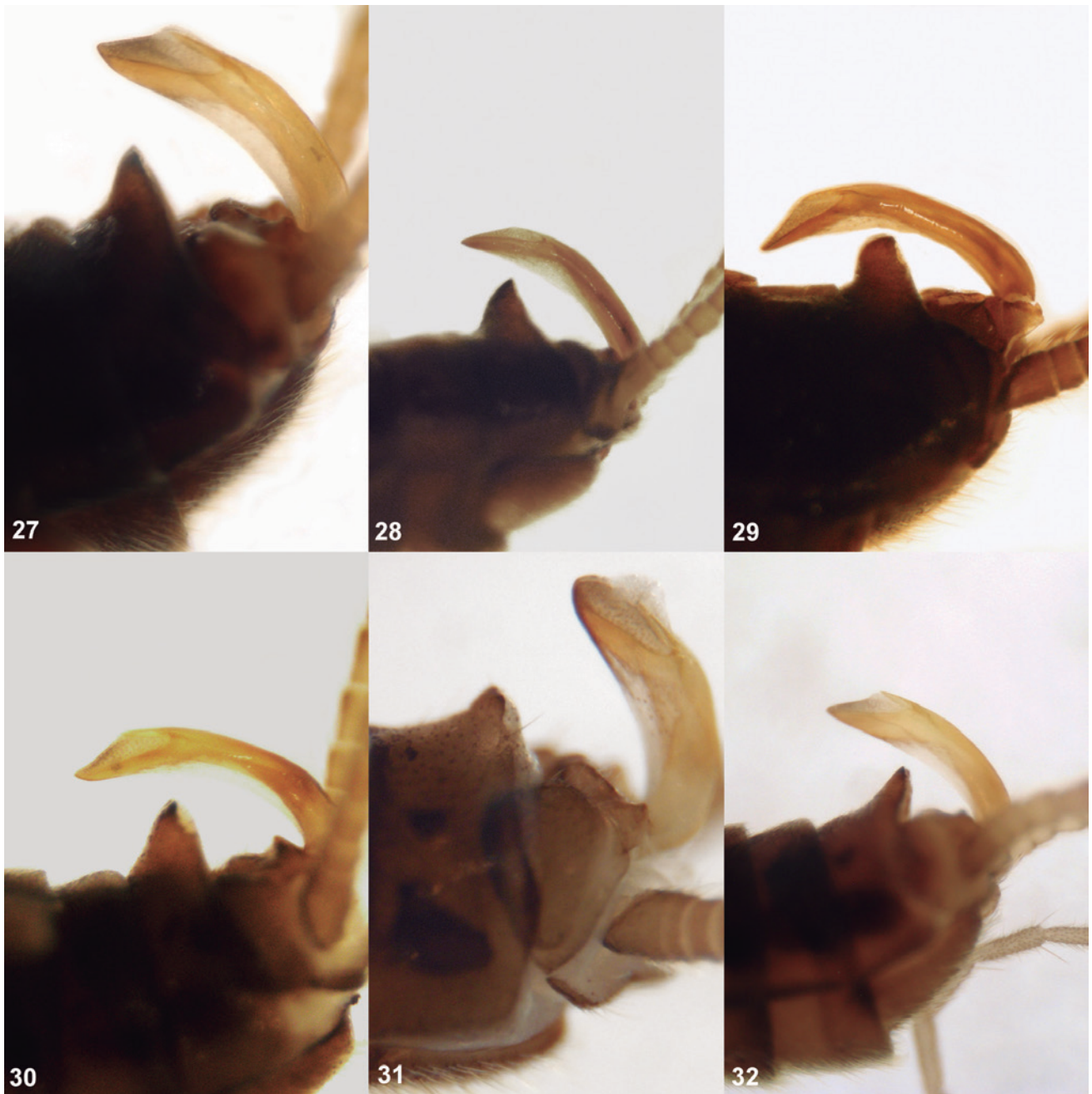
the process on tergite 9 has a wide base, is highly elevated and has a dome-shaped apex (Fig. 6), not resembling any of the numerous illustrations of this feature provided by Murányi *et al.* (2014: 61, figs. 148–164). The ventral vesicle of *Zwicknia avilensis* **sp. n.** is very large and rounded (Fig. 10), much larger than the one of *Z. ledoarei* (Fig. 37; Reding *et al.* 2016: 141, fig. 5) or *Z. rupprechtii* (Fig. 38; Murányi

et al. 2014: 48, fig. 91), but not mussel-shaped as the one of *Z. gattolliati* (Fig. 36) and *Z. acuta* (Fig. 34; Murányi *et al.* 2014: 39, fig. 79), and not elliptical as the one of *Z. bifrons* (Fig. 33; Murányi *et al.* 2014: 41, fig. 83) and *Z. westermanni* (Fig. 35). Note that the ventral vesicle, that males use for generating their bioacoustic drumming signals, is not visible in part of the specimens, because retracted, partly or entirely,

under sternite 8 until the start of the drumming activity. The main epiproct sclerite of *Zwicknia avilensis* **sp. n.** has a small “hunchback” in its median dorsal region (Figs. 3, 4, arrow), a feature not seen on any other presently described species of *Zwicknia* (Figs. 27–32) from Western and Southern Europe.

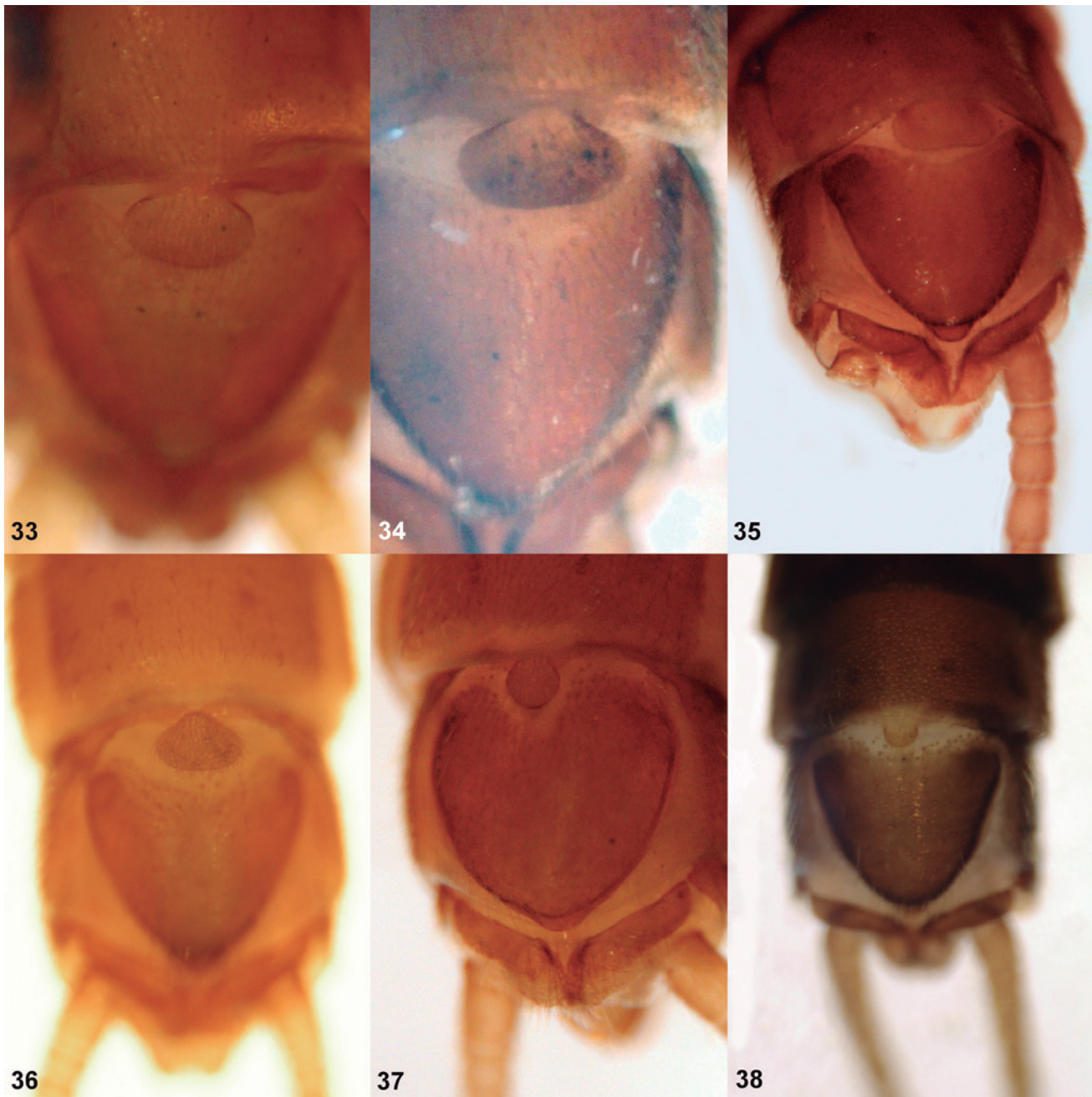
Adult females. In *Zwicknia avilensis* **sp. n.**, the posterior edge of the female subgenital plate is crescent-shaped (Fig. 12), whereas it is nearly

straight in other species, such as *Z. bifrons* (Fig. 41), *Z. ledoarei* (Fig. 42), *Z. gattolliati* (Fig. 43) and *Z. westermanni* (Fig. 44), except for *Z. acuta* (Murányi *et al.* 2014: 34, fig. 64), where it is also crescent-shaped. Like all other known species of *Zwicknia*, *Z. gattolliati* excepted (Fig. 40), female adults of *Z. avilensis* **sp. n.** have short bristles on the dorsal edge of femora and tibiae of all three legs (Fig. 11; cf. Fig. 39). *Zwicknia gattolliati* is,



Figs. 27–32.— Epiproct and process on tergite 9 of adult males of *Zwicknia*. **27**, *Zwicknia bifrons* (Jura Mountains); **28**, *Zwicknia acuta* (Slovakia); **29**, *Zwicknia westermanni* (Occitanie); **30**, *Zwicknia gattolliati* (Apennines); **31**, *Zwicknia ledoarei* (Jura Mountains); **32**, *Zwicknia rupprechtii* (Vosges).

Figs. 27–32.— Epiprocto y proceso del 9° terguito de machos adultos de *Zwicknia*. **27**, *Zwicknia bifrons* (Montañas del Jura); **28**, *Zwicknia acuta* (Eslovaquia); **29**, *Zwicknia westermanni* (Occitania); **30**, *Zwicknia gattolliati* (Apeninos); **31**, *Zwicknia ledoarei* (Montañas del Jura); **32**, *Zwicknia rupprechtii* (Vosgos).



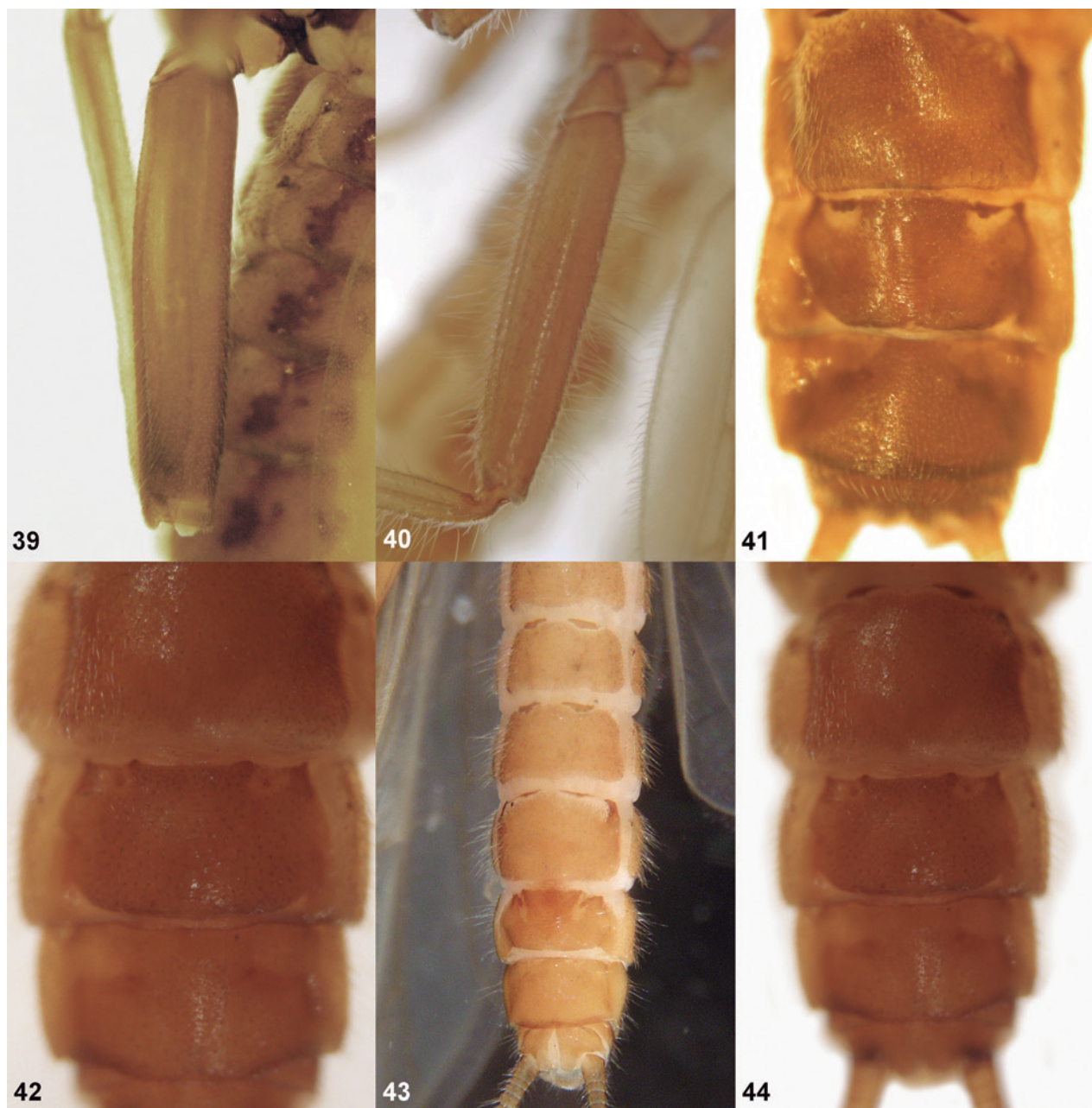
Figs. 33–38.— Ventral vesicle of adult males of *Zwicknia*. **33**, *Zwicknia bifrons* (Jura Mountains); **34**, *Zwicknia acuta* (Slovakia); **35**, *Zwicknia westermanni* (Occitanie); **36**, *Zwicknia gattolliati* (Apennines); **37**, *Zwicknia ledoarei* (Jura Mountains); **38**, *Zwicknia rupprechtii* (Vosges).

Figs. 33–38.— Vesícula ventral de machos adultos de *Zwicknia*. **33**, *Zwicknia bifrons* (Montañas del Jura); **34**, *Zwicknia acuta* (Eslovaquia); **35**, *Zwicknia westermanni* (Occitania); **36**, *Zwicknia gattolliati* (Apeninos); **37**, *Zwicknia ledoarei* (Montañas del Jura); **38**, *Zwicknia rupprechtii* (Vosgos).

to the present knowledge, the only species of the Western Palearctic whose females have long setae on the dorsal edge of their femora and tibiae (Fig. 40; Vinçon & Reding 2018: figs. 8 and 11; Reding 2021).

Larvae. In larvae of *Zwicknia avilensis* **sp. n.**, the erect bristles on head and pronotum are dense, compact and very short (Figs. 15–17), even the shortest among all other larvae of *Zwicknia* examined so far (*Z. bifrons*, *Z. westermanni*, *Z. ledoarei*, *Z. rupprechtii* and *Z. gattolliati*; Reding 2020: Vol. 4,

figs. 17A2, 17A14, 17B9, 17C3 and 17C4). The bristles on the head of *Zwicknia rupprechtii* are also very short, but uncompact (Fig. 52; cf. Figs. 15, 17). In lateral view, tergite 10 of mature male larvae of *Zwicknia avilensis* **sp. n.** is smoothly truncated (Fig. 25), or slightly pointed (Fig. 26), and different from those of *Capnia vidua* (Fig. 45), *Capnia nigra* (Fig. 46), *Zwicknia westermanni* (Fig. 47), *Z. bifrons* (Fig. 48), *Z. ledoarei* (Fig. 49), *Z. gattolliati* (Fig. 50) and *Z. rupprechtii* (Fig. 51).



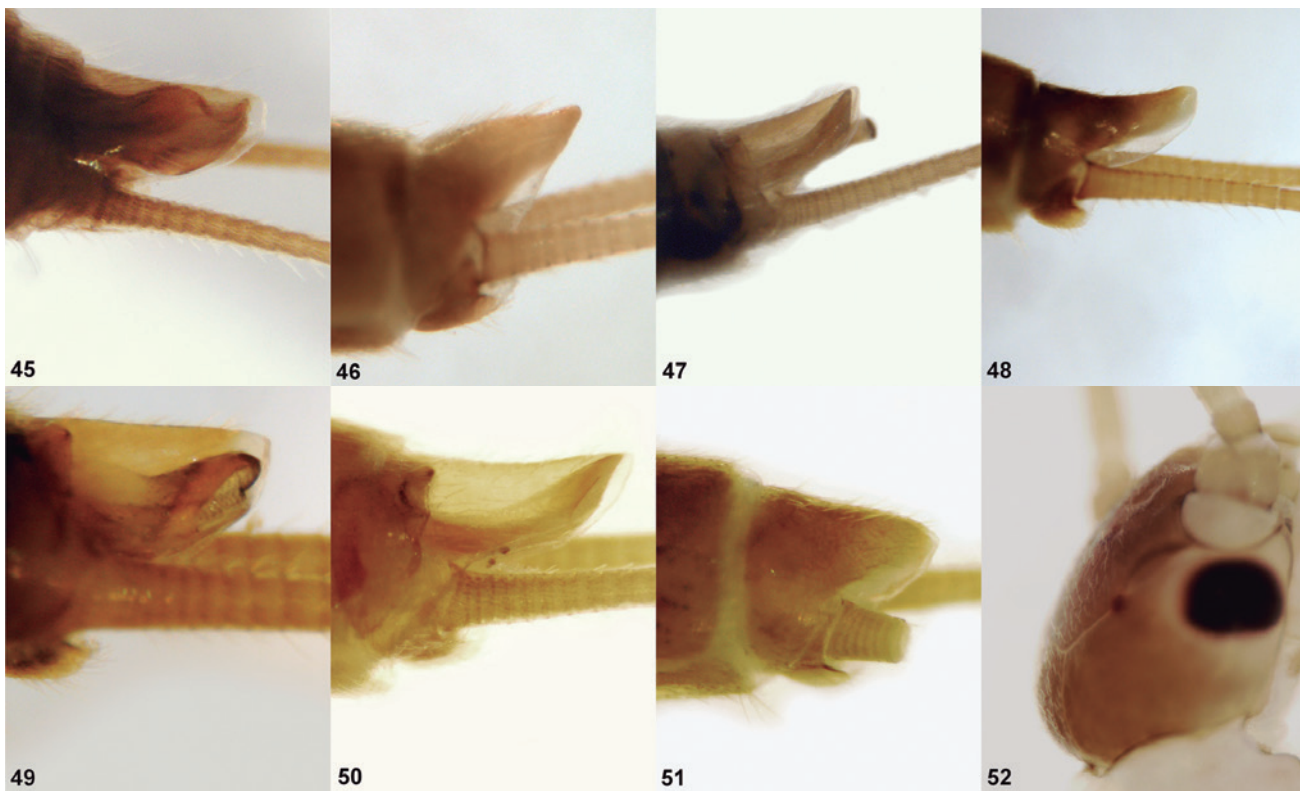
Figs. 39–44.— Adult females of *Zwicknia*. **39**, femur of hindleg of *Zwicknia bifrons* (Jura Mountains); **40**, femur of hindleg of *Zwicknia gattolliati* (Apennines); **41**, subgenital plate of *Zwicknia bifrons* (Jura Mountains); **42**, subgenital plate of *Zwicknia ledoarei* (Jura Mountains); **43**, sternites and subgenital plate of *Zwicknia gattolliati* (Apennines); **44**, subgenital plate of *Zwicknia westermanni* (Occitanie).

Figs. 39–44.— Hembras adultas de *Zwicknia*. **39**, femur posterior de *Zwicknia bifrons* (Montañas del Jura); **40**, femur posterior de *Zwicknia gattolliati* (Apeninos); **41**, placa subgenital de *Zwicknia bifrons* (Montañas del Jura); **42**, placa subgenital de *Zwicknia ledoarei* (Montañas del Jura); **43**, esternitos y placa subgenital de *Zwicknia gattolliati* (Apeninos); **44**, placa subgenital de *Zwicknia westermanni* (Occitania).

DISTRIBUTION AND ECOLOGY

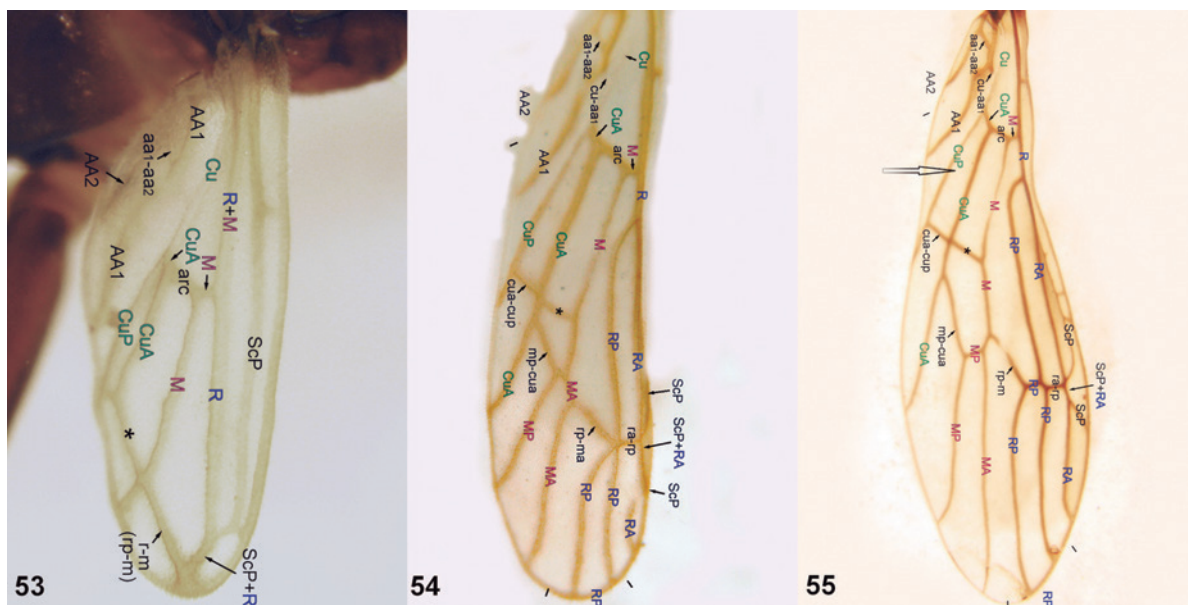
The type material of *Zwicknia avilensis* **sp. n.** has been collected above 1000 m in the Sierra de la Serrota, located within the mountain ranges of the Sistema Central, in small temporary brooks in the headwaters of the Duero basin (Fig. 56). The collection dates for the species indicate a winter flight period, from December to March. Isolated females, however, are still found in April, when

no males are on the wing anymore. The overall distribution of *Zwicknia avilensis* **sp. n.** in Spain is presently unknown. The species inhabits brooks and rivers that dry up in summer (Fig. 56; González del Tánago 1984). In December 2020, the species was found with *Leuctra maroccana* Aubert, 1956c and *Capnioneura libera*; in April 2021 with *Brachyptera arcuata* (Klapálek, 1902) and *Protonemura asturica* (Aubert, 1954).



Figs. 45–52.— **45–51.** Lateral view of epiproct of mature male larvae of *Capnia* and *Zwicknia*. **45**, *Capnia vidua* (Swiss Alps); **46**, *Capnia nigra* (Greater Geneva region); **47**, *Zwicknia westermanni* (Occitanie); **48**, *Zwicknia bifrons* (Jura Mountains); **49**, *Zwicknia ledoarei* (Jura Mountains); **50**, *Zwicknia gattolliati* (Apennines); **51**, *Zwicknia rupprechti* (Vosges). **52.** Setation on head of *Zwicknia rupprechti* (Vosges).

Figs. 45–52.— **45–51.** Vista lateral del epiprocto de larvas macho maduras de *Capnia* y *Zwicknia*: **45**, *Capnia vidua* (Alpes suizos); **46**, *Capnia nigra* (región Gran Ginebra); **47**, *Zwicknia westermanni* (Occitania); **48**, *Zwicknia bifrons* (Montañas del Jura); **49**, *Zwicknia ledoarei* (Montañas del Jura); **50**, *Zwicknia gattolliati* (Apeninos); **51**, *Zwicknia rupprechti* (Vosgos). **52.** Setación de la cabeza de *Zwicknia rupprechti* (Vosgos).



Figs. 53–55.— Wing venation of *Zwicknia* (annotations by Dr. Olivier Béthoux): **53**, wing venation of micropterous male of *Zwicknia gattolliati*; **54**, wing venation of brachypterous male of *Zwicknia westermanni*; **55**, wing venation of macropterous female of *Zwicknia ledoarei*.

Figs. 53–55.— Venación alar de *Zwicknia* (anotaciones del Dr. Olivier Béthoux): **53**, venación alar del macho micróptero de *Zwicknia gattolliati*; **54**, venación alar del macho braquíptero de *Zwicknia westermanni*; **55**, venación alar de la hembra macróptera de *Zwicknia ledoarei*.



Fig. 56.— Collecting locality of *Zwicknia avilensis* sp. n. (Sierra de la Serrota, Arroyo de Canto Moreno, Muñotello).

Fig. 56.— Localidad de recolección de *Zwicknia avilensis* sp. n. (Sierra de la Serrota, Arroyo de Canto Moreno, Muñotello).

CONSERVATION STATUS

In 1981, the species was reported from 14 different sampling stations in the headwaters of river Duero (González del Tánago 1984). In 2020 and 2021, the species is still extant in at least one of its former locations (samplings by the second author). Further collecting is needed to ascertain the present conservation status of the species.

Identification key for adult *Zwicknia* from Western and Southern Europe

- 1 Characteristic process on tergite 9 (Figs. 1–4, 5, 27–32). Presence of a ventral vesicle at the center of the posterior margin of sternite 8 (Figs. 10, 33–38). Micropterous (Figs. 9, 53) or brachypterous (Fig. 54) **3 (male adults of *Zwicknia*)**
 - No characteristic process on tergite 9. Macropterous (or slightly brachypterous in some specimens from the British-Irish Isles), with anterior wing with a reduced number of cross-veins (three) between CuA and M (Fig. 55; cf. Fig. 14). First cell between CuA and CuP in anterior wings quadrangular in shape (Figs. 13, 55). Posterior margin of subgenital plate (sternite 8) rectilinear, slightly rounded or crescent-shaped (Figs. 12, 41–44) **2 (female adults of *Zwicknia*)**
- 2 Femora and tibiae with long and dense setae (Figs. 40). Margins of tergites and sternites with a dense row of setae, well visible in ventral view (Fig. 43) ***Zwicknia gattolliati***
 - Femora and tibiae with only short setae (Figs. 11, 39). Margins of tergites and sternites without a dense row of setae well visible in ventral view (Figs. 12, 41–42, 44) ... **other female adults of *Zwicknia* (not keyed out)**
- 3 Brachypterous (Fig. 54). Veins R and M not fused in the proximal part of the forewings (Fig. 54) **4**
 - Micropterous (Figs. 9, 53). Veins R and M (and sometimes also ScP) fused at least in the proximal part of the forewings (Fig. 53) **5**
- 4 Main epiproct sclerite very long and slender, almost reaching tergite 7 (Fig. 29). Tip of main epiproct sclerite straight, not upcurved, long, narrow, regularly bent and pointed at apex, in lateral view (Fig. 29). Process on tergite 9 highly elevated and perpendicularly raised (Fig. 29). Ventral vesicle large, half as wide as the subgenital plate and elliptical (Fig. 35) ***Zwicknia westermanni***
- 5 Process of tergite 9 projecting caudally (Fig. 32) or orientated headward (Figs. 1–4) **6**
 - Process of tergite 9 perpendicularly elevated, not projecting caudally or headward (Figs. 27–31) **7**
- 6 Process of tergite 9 projecting caudally (Fig. 32). Tip of main epiproct sclerite large and pointed in lateral view (Fig. 32). Ventral vesicle small and rounded (Fig. 38) ***Zwicknia rupprechtii***
 - Process of tergite 9 projecting headward (Figs. 1–4). Tip of main epiproct sclerite straight, neither downcurved nor upcurved and blunt (Figs. 1–4). Ventral vesicle very large and rounded (Fig. 10) ***Zwicknia avilensis* sp. n.**

- 7 Process of tergite 9 very low, its height not reaching half the length of the corresponding tergite (Fig. 31). In lateral view, the tip of the main epiproct sclerite is blunt and nearly rounded (Fig. 31). Ventral vesicle very small and rounded (Fig. 37) ***Zwicknia ledoarei***
- Process of tergite 9 high, its height higher than half the length of the corresponding tergite 9 (Figs. 27–28, 30) **8**
- 8 In lateral view, the tip of the main epiproct sclerite is slender, long, narrow and pointed (Figs. 28, 30) **9**
- In lateral view, the tip of the main epiproct sclerite is bulky, pointed, wide-angled and short, slightly up-curved (Fig. 27). Process of tergite 9 very high and perpendicularly elevated (Fig. 27). Ventral vesicle large and elliptical in shape (Fig. 33) ***Zwicknia bifrons***
- 9 The tip of the main epiproct sclerite is straight, not up-curved (Fig. 28). Main epiproct sclerite very slender and thin (Fig. 28). Ventral vesicle large and mussel-shaped (Fig. 34) ***Zwicknia acuta***
- The tip of the main epiproct sclerite is very slightly up-curved (Fig. 30). Ventral vesicle medium-sized and mussel-shaped (Fig. 36) ***Zwicknia gattolliati***

Discussion

Navás (1917) mentions two new species of *Capnia* from Spain, *C. dusmeti* and *C. maynari*. The corresponding type specimens are lost (Aubert 1956a). According to Aubert (1956b), *Capnia maynari* is a synonym of *C. nigra*, and *Capnia dusmeti* a synonym of *Capnia bifrons*. *Capnia maynari* had been described by Navás (1917) on the basis of a single female, but the drawing of the wing venation in Navás (1917: fig. 4; cf. Fig. 14) clearly shows that the first cell between CuA and CuP in the anterior wing is triangular in shape. *Capnia maynari* hence belongs to the genus *Capnia*, while *C. dusmeti*, also described by Navás (1917) from a single female, belongs to the genus *Zwicknia*, since the first cell between CuA and CuP in the anterior wing of this specimen is quadrangular in shape (cf. Figs. 13, 55; Navás 1917: fig. 3; Aubert 1959: 26, fig. 22; Reding 2020: vol. IV, fig. 17A20). *Capnia* (*Zwicknia*) *dusmeti* had been collected at the Escorial, Sierra de Guadarrama, on March 26th 1916. The taxonomic identity of *Capnia dusmeti* has never been clearly established and the taxon is considered as a *nomen dubium* by Murányi *et al.* (2014: 56), as a synonym of *Capnia bifrons* by Aubert (1952: 247; 1956b) and Illies (1966), and as a synonym of *Zwicknia bifrons* by DeWalt *et al.* (2021). In the past, the now obsolete taxon *Capnia bifrons* has been mentioned from Spain by many authors (Navás 1917; Puig García 1984; González del Tánago 1984; Sánchez-Ortega & Tierno de Figueroa 1996; Luzón-Ortega & Tierno de Figueroa 2000; Tierno de Figueroa *et al.* 2003; Vinçon & Pardo 2004; Graf *et al.* 2009; Luzón-Ortega *et al.* 2013). Since these records have not yet been revised after the breaking up of the former taxon *Capnia bifrons* into different species of the genus

Zwicknia, it is presently not possible to decide whether all of them belong to *Zwicknia avilensis* **sp. n.**, or to different, currently described or yet unknown species, of the genus *Zwicknia* (Tierno de Figueroa *et al.* 2014, 2018). Previous hints as to the possible existence of unknown species of *Zwicknia* in Spain had been provided by Rupprecht (1997), Murányi *et al.* (2014: 56) and Boumans & Murányi (2014), on the basis of drumming and genetic studies.

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