Commented and illustrated key for identification of *Agaue chevreuxi* (Trouessart, 1889) and *A. panopae* (Lohmann, 1893) (Acari, Halacaridae)

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Abstract

The Mediterranean gives home to three named *Agaue* species, two of them are at a quick glance very similar, namely *Agaue chevreuxi* and *A. panopae*, their idiosoma and legs have almost the same size and shape. The idiosoma, gnathosoma, legs, and details of these are illustrated and distinguishing characters described. Characters of a third Mediterranean species, *Agaue adriatica*, are outlined.

Key words: Halacaroidea, *Agaue*, pictorial key, Mediterranean, North Atlantic.

Introduction

At present, three named *Agaue* species are recorded from the Mediterranean Sea, *Agaue adriatica* Viets, 1940, *A. chevreuxi* (Trouessart, 1889) and *A. panopae* (Lohmann, 1893). All three species have a cerotegumental cover on idiosoma and telofemora, the OC have two corneae and dark eye pigment, there is a single dorsal seta on the posterior epimeral plates, a slender rostrum, and club-shaped tibiae. *Agaue adriatica* is easily distinguished from the other two species because of its large, honeycomb-like sculptured lamellae and rather short rostrum, only slightly longer than the gnathosomal base. *Agaue chevreuxi* and *A. panopae* are somewhat larger than *A. adriatica*, their cerotegumental lamellae rather smooth and narrow, their rostrum long, more than 1.5 times the length of the gnathosomal base. At low magnification both look very similar. Lohmann (1893), Viets (1940), Mari & Morselli (1990), and Bartsch (1998) outlined differences between these two species, in the present paper these and additional distinguishing characters are described and illustrated.

Material and Methods

The specimens illustrated are from the French coast of the Mediterranean (*A. panopae*) and from Morocco (Tanger), the Mediterranean (France) and Black Sea (Crimea, Sevastopol) (*A. chevreuxi*). Included in the presentation are data from published descriptions (Trouessart 1889a, b, c; Lohmann 1893; Viets 1928, 1940; Mari & Morselli 1990; Morselli & Mari 1985, 1993; Bartsch 1998), slides housed in the Centrum für Naturkunde (Zoological Museum), University of Hamburg, and the author's collection.
The abbreviations used in the text are: AD, anterior dorsal plate; AE, anterior epimeral plate; ds-1 to ds-6, dorsal idiosomatic setae numbered from anterior to posterior; GA, genitoanal plate; GO, genital opening; mxs-1, mxs-2, basal and following pair of maxillary setae; OC, ocular plate(s); P-2 to P-4, second to fourth palpal segment(s); pas, parambulacral seta(e); PD, posterior dorsal plate; PE, posterior epimeral plate(s); pgs, perigenital setae. The legs and their segments are numbered I to IV.

Figure 1. *Agaue chevreuxi* (Trouessart, 1889). A - idiosoma, dorsal, female. B - seta ds-3, female. C - ocular plate, female. D - anterior part of AD, female. E - idiosoma, ventral, female. F - genitoanal plate, female. G - genitoanal plate, male.

Figure 2. *Agaue panopae* (Lohmann, 1893). A - idiosoma, dorsal, female. B - seta ds-3, female. C - ocular plate, female. D - anterior part of AD, female. E - idiosoma, ventral, female. F - genitoanal plate, female. G - genitoanal plate, male. Scale = 50 µm. (arrows indicate differences in character states; ce, cerotegument; cp, coarse porosity; dpa, areola with delicate porosity; ds-2, second dorsal idiosomatic seta; fo, foveate ornamentation; glp, gland pore; ov, ovipositor; pgs, perigenital setae; pi, eye pigment; sp, spermatopositor)
Agaue chevreuxi and A. panopae, description and comparison of adults

Agaue chevreuxi (Trouessart, 1889) was first mentioned in Trouessart (1889a) under the name of Leptopsalis chevreuxi, it had been extracted from a sample dredged in 35 brasses (ca 57 m) depths off Croisic, France, North Atlantic. In Trouessart (1889b, c), short descriptions were published; the given records were both from French Atlantic and Mediterranean coastlines. The total length of the species was said to be 800–900 µm (which would equal an idiosomal length of about 600–700 µm). The species is characterized by club-shaped tibiae, a slender gnathosoma with a long rostrum (hypostome très long), and large claw fossae. A first illustration on the basis of individuals taken in the English Channel was presented a decade later (Trouessart 1898: plate 12), but according to Trouessart it represents a variety with enlarged lamellae. More details of A. chevreuxi were added by Viets (1928: 57, figs 17–22, 1940: 64, 71, figs 111–115), Mari & Morselli (1990: 247, table I, 1a–c) and Bartsch (1998: 144, figs 1–8). The adults illustrated by Lohmann (1893: plate IV, figs 3–5) were from the south-western Pacific, Sydney, and are most likely not conspecific with the North Atlantic species, they may represent the species now called Agaue galatea Otto, 1999. The collecting locality of the species of which leg I was illustrated (Lohmann 1893 text-fig. 6) is not known.

Agaue panopae (Lohmann, 1893) was described by Lohmann (1893) as Halacarus panopae. The description was based on specimens collected near the Cape Verde Islands, Sydney (Australia) and off the coast of Brazil. The first-mentioned locality is expected to be the locus typicus and the female illustrated in Lohmann (1893: pl. III, fig. 1) the holotype. The individuals from Sydney are certainly not conspecific with Agaue panopae. The description given by Lohmann (1893) includes specimens from all three localities, their characters are: cerotegumental cover rather inconspicuous, smooth or, if at all, only slightly reticulate; anterior margin of PD truncate; tibiae I to IV club-shaped, tibia I with five, tibia II with four ventral setae; dorsal seta on P-3 short, smooth, on P-2 either wide, squamose and bifurcate or slender and setiform. The idiosoma of specimens from the Cape Verde Islands was within a length range of 320–360 µm (Lohmann 1893). Lohmann (1893) mentioned varieties, one had almost smooth dorsal plates and on P-2 a squamose, bifurcate seta (forma squamifera), the other reticulate dorsal plates and a slender seta (forma setifera). The shape of the seta on P-2 turned out to be an example of sexual dimorphism (Morselli & Mari 1985). Females of A. agaoides (Lohmann, 1907) (Newell 1984: fig. 142; Bartsch 2016: fig. 1D), A. parva (Chilton, 1883) (Bartsch 1993: fig. 39B) and A. villosa (Lohmann, 1907) (Newell 1984: fig. 171; Bartsch 1993: fig. 43B) have a flattened, furcate or branched seta on P-2, whereas in males of the two first mentioned species the seta on P-2 is smooth and slender (Bartsch 1993: fig. 39C, 2016: fig. 1E).

Lohmann (1893) mentioned three characters which help to separate Agaue chevreuxi from A. panopae, namely the size (total length 560–780 µm versus 470–590 µm), the shape of the setae on P-2 and P-3 (both slender and smooth versus seta on P-2 often squamose and bifurcate, that on P-3 spiniform) and number of ventral setae on tibia II (five versus four). Viets (1940), Mari & Morselli (1990) and Bartsch (1998) added further discriminating characters but still more exist, as described on the following lines.

Idiosoma. Length of idiosoma of A. chevreuxi female 570–755 µm, of male 567–628 µm (Mari & Morselli 1990; Bartsch 1998) and of A. panopae female 554–563 µm, of male 493–555 µm (Morselli & Mari 1985, 1993; Mari & Morselli 1990) (the data given in Trouessart (1889a, b, c) and Lohmann (1893) are omitted, those by Lohmann are from individuals from different parts of the world). Agaue chevreuxi is larger than A. panopae, but the difference in length is generally small. Mari & Morselli (1990: plate I, figs 1a, 2a, 3a) presented the dorsal aspect of the three documented Mediterranean species, the idiosoma of A. panopae is slightly more slender than that of A. chevreuxi and A. adriatica. Such a difference is often negligible, especially in females. Ovigerous females which carry numerous eggs have the striated integument dilated and hence a wider idiosoma.

The outline of AD, OC and PD are similar in the two species A. chevreuxi and A. panopae. The dorsal plates bear longitudinal cerotegumental costae; the AD also an anterior ovate areola beside the two costae which in general do not meet anteriorly (Figs 1A, 2A). The integument beneath the cerotegument demonstrates a delicate porosity whereas the parts lateral and medial to the lamellae have coarse pores (rarely just faint ones) (Figs 1C, D, 2C, D). The cerotegumental cover of A. chevreuxi is raised, its surface often smooth, rarely including thin lamellae, the cover of A panopae is not as thick as in A. chevreuxi and always smooth. The AD and dorsal portion of AE are fused anteriorly, in A. chevreuxi the striae between the plates do not reach the gland pores (Fig. 1D), whereas in A. panopae the striae extend anteriorly beyond the gland pores and the pores are situated on the AD (Fig. 2D). Each OC bears two spherical lenses, between them dark eye pigment; a gland pore is in the lateral margin posterior to the lenses (Figs 1D, 2D). Slight differences in the outline of the OC illustrated are artefacts, the OC of A. chevreuxi (Fig. 1C) is drawn from a
somewhat compressed but intact idiosoma, whereas the OC of *A. panopae* (Fig. 2C) is from a specimen in which the dorsal and ventral plates had been separated. The PD of *A. chevreuxi* is 1.5–1.6 times longer than wide, has generally a broadly ovate, rarely truncate anterior margin and a delicate, foveate ornamentation (exceptions exist), in *A. panopae* the PD is 1.8–1.9 times longer than wide, the anterior margin is truncate and the surface of the plate smooth. In many *Agaue* species the setae ds-2, ds-3 and ds-4 differ in size and shape from the ds-1 and ds-5. In *A. chevreuxi* these three pairs of setae are short, 32–40 µm long, and surrounded by cerotegument (Fig. 1B). In contrast, in *A. panopae* the ds-2, ds-3 and ds-4 are 57–80 µm long (Fig. 2B), hence generally distinctly longer than the ds-1 and ds-5 which have a length of 20–50 µm. There is no marked difference between females and males in the size and arrangement of the setae.

In the two species, the majority of the specimens studied have uniformly porose ventral plates, but in two individuals of *A. chevreuxi*, from the south-western coast of Spain (Cadiz), the ornamentation of the cerotegument gives the surface of the plates a foveate aspect. Except for the genital plates, there are almost no differences between females and males, the shape and setation of AE and PE (Figs 1E, 2E) is almost the same. The GA of females of *A. chevreuxi* and *A. panopae* is ovate, the number of pgs of *A. chevreuxi* is smaller than that of *A. panopae* (13–17 versus 16–21 pgs) (Viets 1928; Mari & Morselli 1990; Bartsch 1998), in *A. chevreuxi* there are two (rarely three) setae on either side of the antero-lateral margin, in *A. panopae* three to five setae (Fig. 1F, 2F). Moreover, there is a difference in length of the ovipositor in relation to the anterior margin of GA. In *A. chevreuxi* the ovipositor extends to or slightly beyond the anterior margin of GA, in *A. panopae* beyond the GA by almost the length of the GO. The GA of males is wider than that of females. Differences between the species are in the number of pgs, about 81–90 in *A. chevreuxi* and 100–110 in *A. panopae* (Figs 1G, 2G, Mari & Morselli 1990; Bartsch 1998). In *A. chevreuxi*, the spermatopositor extends to (Fig. 1G), but also somewhat beyond the anterior margin of the genital plate, in *A. panopae*, in the single male studied, it extends somewhat beyond that margin (Fig. 2G).

**Figure 3.** *Agaue chevreuxi* (Trouessart, 1889). A - gnathosoma, ventral, female. B - tip of palps, dorsal, female. C - apical part of palp, chelicera and rostrum, lateral, male.

**Figure 4.** *Agaue panopae* (Lohmann, 1893). A - gnathosoma, ventral, female. B - tip of palp, dorsolateral, female. C - apical part of palp and rostrum, lateral, male. Scale = 50 µm. (arrows indicate differences in character states; fs, furcate seta; mxs-1, basal pair of maxillary setae; pa, porose areola; s, seta; so, solenidion; pa, porose areola; rs, rostral seta).
Figure 5. *Agaue chevreuxi* (Trouessart, 1889). A - leg I, medial, female. B - tip of tarsus II, medial, female (lateral eupathidia in broken line, lateral claw and fossary seta omitted). C - leg II, medial, female. D - tip of tarsus III, lateral, female (medial claw and setae omitted). E - leg III, medial, female. F - claw of tarsus IV, medial, female.

Figure 6. *Agaue panopae* (Lohmann, 1893). A - leg I, medial, female. B - tip of tarsus II, medial, female (lateral eupathidia in broken line, lateral claw and fossary seta omitted). C - leg II, medial, female. D - tip of tarsus III, medial, female (lateral claw and setae omitted). E - leg III, medial, female. F - claw of tarsus IV, medial, female. Scale = 50 μm. (arrows indicate differences in character states; acp, accessory process; ce, cerotegument; so, solenidion)

**Gnathosoma.** The gnathosoma is slender in both species, its length more than 2.0 times the width (Lohmann 1893; Bartsch 1998) (Figs 3A, 4A). The cerotegumental cover on the gnathosomal base is thin in *A. chevreuxi*, inconspicuous in *A. panopae*. Within a ring-like area, interrupted only by the pharyngeal field, the integument of the gnathosomal base is porose. The tectum is scaliform. The rostrum of *A. chevreuxi* and *A. panopae* is slender, extends beyond the middle of P-4, in both species it is about twice as long as the...
gnathosomal base (1.8–2.1 times) (Bartsch 1998). In A. *chevreuxi* the length of the mxs-2 is less than one quarter of that of the mxs-1 (Fig. 3A) whereas in A. *panopae* (Fig. 4A) it is about half of that of the mxs-1 (mxs-2, 50–60 µm, mxs-1, 100–105 µm). The apical rostral setae are short, divaricate. The palps are slender. P-2 and P-3 bear one dorsomedial seta each. The seta on P-2 is slender in A. *chevreuxi* (Fig. 3B), in females about 24 µm long, but in females of A. *panopae* it is scaliform and furcate, 12 µm long (Fig. 4B). Males of both species have a slender seta on P-2, 20–25 µm long (Figs 3C, 4C). In females and males of A. *chevreuxi* the dorsal seta on P-3 is distinct, similar though somewhat shorter than that on P-2 (16–20 µm), in females of A. *panopae* that seta is spiniform, its length 11–12 µm. The P-4 bears three setae in the basal whorl, a long dorsolateral solenidion and apically one slender setula and two euppapheid setae.

**Legs.** Both species have club-shaped tibiae and at a first glance the shape of legs is similar but the cerotegumental lamellae of A. *chevreuxi* are larger than in A. *panopae* (Figs 5A, C, E, 6A, C, E). The height of the dorsal lamellae on telofemur I of A. *chevreuxi* equals at least one third of the segment's height, that of A. *panopae* is one fifth or less. In A. *chevreuxi* the telofemora I to III are 3.1–3.2, 2.4–2.5 and 2.2–2.4 times longer than high, in A. *panopae* 2.9, 2.3 and 2.2–2.3 times, respectively. In both species tibiae I and II are somewhat shorter, but tibiae III and IV somewhat longer than the legs' telofemora. In A. *chevreuxi* the number of setae on the legs, from trochanter to tarsus (solenidia included) is: leg I, 1, 2, 5, 5, 11, 23; leg II, 1, 2, 5, 5, 11, 11; leg III, 2, 2, 3, 4, 8, 5; leg IV, 0–(1), 2, 3, 3, 8, 5; in A. *panopae*: leg I, 1, 2, 5, 5, 11, 20; leg II, 1, 2, 5, 4, 10, 9; leg III, 2, 2, 3, 3, 7, 5; leg IV 0, 2, 3, 3, 7, 5. The genua I to IV of A. *chevreuxi* bear 3/2, 3/2, 3/1, 2/1 dorsal/ventral setae, those of A. *panopae* 3/2, 2/2, 2/1, 1/1; one of the dorsal setae of both genu II and III is lacking in that latter species. On tibiae I to IV of A. *chevreuxi* 6/5, 6/5, 4/4, and 4/4 dorsal/ventral setae are found, respectively, on those of A. *panopae* 6/5, 6/4, 3/4, and 3/4 setae. Of the five ventral setae on tibia II of A. *chevreuxi* two are ventromedial and three ventralateral in position, of the four ventral setae on tibia II of A. *panopae* two are ventromedial and two ventralateral in position. The tarsi have large fossa membranes. Tarsi I of A. *chevreuxi* and A. *panopae* each bear three dorsal setae, a solenidion on the lateral fossa membrane and one ventromedial seta in about the middle of the segment; the species differ in the number of eupathidia, in A. *chevreuxi* there are about 18 (pas included), in A. *panopae* only 15 eupathid setae. Tarsus II of A. *chevreuxi* bears three dorsal setae and on the inside of the medial fossa membrane a 10 µm long solenidion, at the tarsal tip three ventromedial and four ventralateral eupathidia (doubled pas included) (Fig. 5B). The tarsal II chaetotaxy of A. *panopae* is similar except for the lower number of eupathidia on the tip of the tarsus, namely a single ventral seta and a pair of doubled eupathidia (Fig. 6B). Tarsi III and IV have three dorsal setae and a pair of filiform pas (Figs 5D, 6D). The claws differ in shape and number of tines. Most A. *chevreuxi* have 16–18 tines arranged along the concave flank of the claws (Fig. 5B, D, F) and distinctly raised accessory processes, each with six tines. In A. *panopae* the pectines, with 7–8 tines each, are restricted to the middle part of the concave flank (Fig. 6B, D, F), the accessory process is slightly raised and includes three to four tines.

**Discussion and Conclusion**

As demonstrated, A. *chevreuxi* and A. *panopae* can be separated on the basis of several morphological characters, though at present the number of specimens studied is small and the range of the character states not known. With more material at hand, variants, as well as intermediate and anomalous character states may be found. According to the descriptions above, the difference in length and ornamentation of the ds-2, ds-3 and ds-4 seems to be distinct but Boyaci & Durucan (2013: fig 3) illustrated a male of A. *chevreuxi* (from the Marmara Sea) with unusual long setae. In general the size of the cerotegumental cover will certainly vary from individual to individual (beside that it may be destroyed when clearing and mounting the mites). One of the distinguishing characters of A. *chevreuxi* is the foveate ornamentation on the PD, but at least in an individual from Morocco (Tanger) that sculpturing is very faint. The length ratio of the ovipositor with reference to the anterior margin of the GA is expected to vary, this may partly be the result of different orientation of the mite on the slide. Variants are often found in respect to the number of setae on the telofemora and tibiae, as e.g. demonstrated in the related species *Agaeae galatea* (Bartsch 2015), such differences are often restricted to one side. Different character states will certainly also be found in A. *chevreuxi* and A. *panopae*. The paired claws of A. *chevreuxi* each have a prominent accessory process and its pectines numerous tines, these are arranged along the ventral flank of the claw, whereas in A. *panopae* the accessory process is only slightly raised and the few tines of the pectines are typically restricted to the middle part of the claw. In contrast to this, Mari & Morselli (1990: fig. 1a) found an A. *panopae* with 'tipo chevreuxi' claws (with raised accessory process and numerous tines), and a female and male taken on the
south-western coast of Spain (Cadiz) and identified as *A. chevreuxi* had only slightly raised accessory processes. An example of an anomaly is that presented by a female of *A. adriatica* from Spain (Cadiz), beside the ds-2 to ds-4 an additional similar sized seta arises from the middle of the right OC.

A few anomalous variants may cause problems but in general *A. chevreuxi* can be separated from *A. panopae* because of: (1) the larger cerotegumental lamellae, especially on the legs; (2) the short ds-2, ds-3 and ds-4, embedded in cerotegument; (3) the lower number of perigenital setae on the female GA, especially in the anterior part of the plate; (4) the slightly lower number of setae on the GA of males; (5) the very short second pair of maxillary setae; (6) the slender dorsal seta on P-2, only slightly longer than that on P-3 and absence of sexual dimorphism; (7) the higher number of setae on the genua and tibiae II; (8) the higher number of setae on the genua and tibiae III; (9) the higher number of ventral setae on the tips of tarsi I and II; (10) the conspicuous accessory process and the higher number of tines on the claws.

Figure 7. *Agaue adriatica* Viets, 1940. A - idiosoma, dorsal, male. B - gnathosoma, ventral, female. C - tip of palp, medial male. D - leg I, medial, female. E - tip of tarsus IV, medial, male (lateral setae and claw omitted). Scale = 50 µm.

A third named *Agaue* species known from the Mediterranean is *Agaue adriatica*. The idiosoma of females is 440–539 µm long, that of males 442–510 µm (Viets 1940; Morselli & Mari 1993; unpublished data). *Agaue adriatica* can be separated from *A. chevreuxi* and *A. panopae* on the basis of the wide cerotegumental lamellae on idiosoma and legs with their honey comb-like ornamentation. On the AD, the two cerotegumental lamellae are fused anteriorly, forming an inverted 'V'. The opposing margins of the AD and PD are ovate (Fig. 7A), not truncate; the PD is foveate, at least in its middle part. The marginal parts of AE
and PE have a cerotegumental cover. The ovipositor extends to the anterior margin of GA, and in males the genital opening is surrounded by 70–90 perigenital setae (according to Mari & Morselli 1990) or almost 100 (according to a male collected off Marseille). The rostrum is 1.1–1.2 times longer than the gnathosomal base. The difference in length of the two pairs of maxillary setae is small (Fig. 7B). The seta on P-2 is slender in both female and male, somewhat longer than the length of P-3. The seta on P-3 is small, 3–4 µm long (Fig. 7C) (not recognizable in the holotype and paratypes because of the thickness of the mounting medium). Telofemora I to IV are about 3.3–3.6, 2.7–3.0, 2.4–2.8, and 2.7–2.8 times longer than high, both the dorsal and ventral flank is embedded within an ornamented cerotegumental cover. On telofemur I the height of this cerotegument is slightly less than the height of the segment (Fig. 7D). The chaetotaxy formula of trochanters to tibiae I to IV is: leg I, 1, 2, 5, 5, 10; leg II, 1, 2, 5, 5, 9; leg III, 2, 2, 3, 4, 7; leg IV, 0, 2, 3, 3, 7. Tarsus I bears one ventromedial seta, in about the middle of the segment, and 15 apical eupathidia (parambulacral setae included), tarsus II two small ventral eupathidia and the pair of doubled pas. Each of the tarsi III and IV has a pair of pas singlets but no further ventral setae. The claws are slender, the accessory processes minute, 5–9 tines can be seen in the basal part of the concave flank (Fig. 7E), these tines are small in the type series but coarse in a specimen from Spain (Cadiz).

In addition to the three above mentioned at least a fourth species lives in the Mediterranean. Its idiosomal length equals that of A. chevreuxi. The species can easily be separated from the other three because of its long and slender idiosoma, gnathosoma and legs.

**Geographical distribution**

**Agaue adriatica** Viets, 1940
Northeastern Atlantic: Spain (Cadiz—new record, coll. T. Wittling, October 1996), France (English Channel) (Trouessart 1889). Mediterranean: France (off Marseille—new record, coll. C. Poizat, November 1976), Tyrrenhenian Sea, Italy, Adriatic Sea, Croatia (Rovinj) (Viets 1940; Morselli & Mari 1989, 1993).

According to Mari & Morselli (1990: 255), the individual collected in the English Channel (northeastern Atlantic, France) and illustrated by Trouessart (1889) is not similar to A. chevreuxi but to A. adriatica (or a species similar to the latter). A comparison between Figs 7A, B and D and those in Trouessart (1889, pl. 12) and André (1946: fig. 60) supports the expected identity. Unless studies on new material from the North Atlantic proves the opposite, the record from northern France is included in the area of distribution.

**Agaue chevreuxi** (Trouessart, 1889)
Northeastern Atlantic: Canary Islands, Azores, Morocco (off Tanger—new record, coll. Meniou, September 1984), Spain (Cadiz—new record, coll. T. Wittling, October 1996, and off Santander), France (Viets 1956; André 1946; Riesgo et al. 2010). Mediterranean: France (and off Marseille—new record, coll. C. Poizat, May 1976), Monaco; Tyrrenhenian Sea, Italy (Piombino (Ligurian Sea), Ischia); Adriatic Sea, Italy (Venice), Croatia (Rovinj) (Trouessart 1889b; André 1946; Viets 1940; Krantz 1970; Mari & Morselli 1990). Marmara Sea and Black Sea, Bulgaria, Romania, Crimea, Turkey (Bartsch 2004; Boyaci & Durucan 2013). The Pacific records, from Chile and Australia (Trouessart 1896; Lohmann 1893), are excluded because of unproven identity.

**Agaue panopæae** (Lohmann, 1893)
North Atlantic: mouth of Amazonas (?), Cape Verde Islands, Spain (Galicia) (Lohmann 1893; Pepato 2010). Mediterranean: France (Perpignan and off Marseille—new records, coll. H.-G. Müller, August 1992, and C. Poizat, October 1976), Monaco; Tyrrenhenian Sea, Italy (Piombino, Ischia); Adriatic Sea, Croatia (Rovinj, Split) (Viets 1940; Morselli & Mari 1985, 1993; Mari & Morselli 1990).

Records from the Indian Ocean and Pacific, Western Australia and New South Wales (Australia) (Lohmann 1893, 1909), are excluded because of unproven identity.

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