

Drusia (Drusia) valenciennii (Webb & Van Beneden, 1836)

(Gastropoda, Pulmonata, Parmacellidae),

a species new for the Netherlands and northwestern Europe

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INDEN, M.G.R.M., NECKHEIM, C.M. & MARGRY, C.J.P.J., 2020. *Drusia (Drusia) valenciennii* (Webb & Van Beneden, 1836) (Gastropoda, Pulmonata, Parmacellidae), a species new for the Netherlands and northwestern Europe. – *Basteria* 84 (4-6): 141-145. Leiden. Published 10 December 2020.

An Iberian semi-slug, *Drusia valenciennii* (Webb & Van Beneden, 1836), was found in 2019 in the Netherlands. When this introduced species was first encountered, only photographs were taken, but a few juveniles were later collected; their raising to maturity is described. One mature specimen was dissected to examine the genitalia and confirm the identification. This is the first record of a *Drusia* species in northwestern Europe.

Key words: Gastropoda, Parmacellidae, *Drusia*, Netherlands, new record, exotic species.

INTRODUCTION

In the spring of 2019, one of us (M. Inden) found two large, unknown slugs at two different places near Santpoort-Noord, the Netherlands. Photographs taken at that time (Fig. 1) were posted on the Waarneming.nl forum and made it clear that this was a remarkable find of a species belonging to the family Parmacellidae P. Fischer, 1856. Because it was undoubtedly an exotic species, the observation was published as soon as possible (de Bruyne et al., 2019; Verschuren, 2019). This is to prevent it being a species that can have harmful consequences for plants, animals, and humans, so that action can be taken quickly if necessary.

Parmacellidae are semi-slugs. Juveniles that hatch have a protoconch in which they can fully withdraw. During maturation, this shell quickly becomes overgrown by the mantle. The last half whorl grows out as a fragile sub-oval part, the so-called limacella, and remains completely hidden from view by the mantle. In adult *Drusia valenciennii* the shell is fully covered by the mantle (Welter Schultes, 2012). The Parmacellidae are known from two regions: Central Asia from the Caucasus as far as Afghanistan (Sysoev & Schileyko, 2009; Gural-Sverlova et al., 2010; Martínez-Ortí & Borredà, 2012; Welter-Schultes, 2012; Yakhchali et al., 2013) and the Canary Islands and countries on the Mediterranean Sea (Alonso et al., 1985; Welter-Schultes, 2012; Martínez-Ortí & Borredà, 2013; Cadevall & Orozco, 2016; Borredà & Martínez-Ortí, 2017). Martínez-Ortí & Borredà (2012) revised the taxonomy of the Parmacellidae and later provided a new identification key to species (Martínez-Ortí & Borredà, 2013).

Externally, the introduced species resembles *Drusia valenciennii* (Webb & Van Beneden, 1836), but only photographs were at first available. After some unsuccessful searches juvenile specimens were found in September 2019 and collected in October 2019 for raising. We document the records, habitat, raising of immature specimens to maturity, and our conclusive identification using one of specimens that we raised to maturity.

RECORDS AND HABITAT

We first observed an adult *Drusia valenciennii* on 30.v.2019 in Burgemeester Rijkenspark between Santpoort-Noord and Santpoort-Zuid, a walking park popularly known as Bosbeek Park in the province of Noord-Holland, The Netherlands. On 9.vi.2019, a second adult was found in the same



Figs 1-4. *Drusia valenciennii* (Webb & Van Beneden, 1836). 1. Live adult slug found on 9.vi.2019 (photo: M. Inden). 2-4. Live adult slug after one year of raising (photos: I. Margry-Moonen). 2. Right side. 3. In dorsal view, showing stripes on the mantle. 4. Sole of foot.

area (Fig. 1). At both times, no specimens were collected and only photographs were taken. On 11.viii.2019, 7.ix.2019, and 8.ix.2019 unsuccessful attempts were made to find the species again. In September and October 2019, additional specimens, but only juveniles, were found: 25.ix.2019, four juveniles with visible shells; 26.ix.2019, three juveniles with overgrown shells; 28.ix.2019, one juvenile with the shell still visible; 14.x.2019, seven juveniles with their shells fully concealed within the mantle.

The animals were found at two different places. All observations of the *Drusia* specimens were made within a radius of 300 m in the park. The first two records at 52.4250°N, 4.6395°E, de last four around 52.4269°N, 4.6402°E. The mixed forest in the park was originally an inner dune forest with old Pedunculate Oak (*Quercus robur*), European Beech (*Fagus sylvatica*), maple (*Acer* sp.), and Corsican Pine (*Pinus niger* var. *corsicana*).

In Burgemeester Rijkenspark the malacofauna included: *Arianta arbustorum* (Linnaeus, 1758), *Arion circumscriptus* Johnston, 1828, *Arion distinctus* J. Mabilie, 1868, *Arion intermedius* Normand, 1852, *Arion rufus* (Linnaeus, 1758), *Arion silvaticus* Lohmander, 1937, *Arion subfuscus* (O.F. Müller, 1774), *Boettgerilla pallens* Simroth, 1912, *Cepaea nemoralis* (Linnaeus, 1758), *Clausilia bidentata* (Ström, 1765), *Cochlicopa lubrica* (O.F. Müller, 1774), *Cochlicopa lubricella* (Porro, 1838), *Cornu aspersum* (O.F. Müller, 1774),

Deroceras invadens Reise, Hutchinson, Schumack & Schlitt, 2011, *Deroceras reticulatum* (O.F. Müller, 1774), *Discus rotundatus* (O.F. Müller, 1774), *Oxychilus alliarius* (Miller, 1822), *Oxychilus cellarius* (O.F. Müller, 1774), *Oxychilus draparnaudi* (H. Beck, 1837), *Helix pomatia* Linnaeus, 1758, *Ambigolimax valentiana* (A. Férussac, 1822), *Limax maximus* Linnaeus, 1758, *Tandonia sowerbyi* (A. Férussac, 1823), *Trochulus hispidus* (Linnaeus, 1758), and *Vitrina pellucida* (O.F. Müller, 1774).

CAPTIVE RAISING OF JUVENILES

A few juvenile specimens were collected on 14.x.2019 for raising to maturity. The animals were kept in a glass container at 10–15°C during the winter, and after that, at ambient temperature. A piece of damp, moss-covered bark and water were made available.

The juvenile semi-slugs grew on a diet of only plant food, which consisted of the leaves of spinach, lettuce, celery, cauliflower, white cabbage, radish, mock strawberry, leaves and flowers of dandelion, and fruits of zucchini, bell pepper, and cucumber. The adults confirmed their omnivorous lifestyle after eating a piece of meat from a can of dog food. The length of the animals increased from 8 cm (27.xii.2019) and 10 cm (11.i.2020) to 12 cm (20.ii.2020). In mid-April

2020, leaf waste mixed with garden soil was offered. The snails crawled into the ground several times. They always kept their tail section protruded above the ground. Judging by their faeces, this substrate was also eaten. At that time matings were observed as well. Once it took at least 7 hours. Before copulation, they constantly crawled over each other and muttered each other with the feelers. The eggs hatch after about one month. On 16.v.2020, juvenile animals with a fully visible shell crawled out of the pot with garden soil.

IDENTIFICATION

In May 2020, a mature specimen was selected for anatomical study. This specimen was 9.5 cm when alive and fully extended. The gray-brown to yellow mantle had dark brown spots and stripes (Figs 2-3) and was darker than the specimen photographed in June 2019 (Fig. 1). The sole was dirty yellow (Fig. 4).

The fragile shell (= protoconch with the limacella) is broadly paddle-shaped, mostly translucent, thin, and wrinkled. Only a part close to the protoconch is calcified and white. Spread out, the shell measures about 14×9 mm (Fig. 5).

The specimen was dissected, and its genitalia were compared to the published descriptions and figures by Simroth (1883), Forcart (1959), Alonso et al. (1985), Martínez-Ortí & Borredà (2012), and Cadevall & Orozco (2016). Only one atrial appendix was present, and the bursa copulatrix was remarkably large. The vagina has a large perivaginal gland. A spherical thickening on the pedunculus is clearly

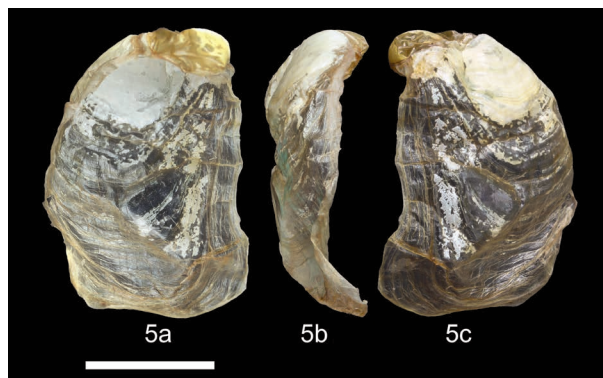


Fig. 5. The shell of an adult slug after one year of raising with the protoconch and the limacella (photos: I. Margry-Moonen). **5a.** Ventral view. **5b.** Lateral view. **5c.** Dorsal view. Scale bar = 5 mm.

visible (Fig. 6a). The pleated stimulator fold of the atrium is bulged through the genital orifice (Figs 6b, 7). The interior of the epiphallus consists of rows of parallel folds (Fig. 8). Within the bursa copulatrix we found one spermatophore, which partly was absorbed and clumped together as well. We could not study the anchoring disc (Fig. 9).

The oxygnathe jaw is 4.4 mm long (Fig. 10). The radula is of the saber type (Jungbluth et al., 1981). The central tooth has a mesocone that spans about $2/3$ of its length. The endocons and ectocons of the marginal teeth remain visible to the outside of the radula. The outer marginal rows of teeth are barely developed and present as rectangular plates (Fig. 11).

We used the identification key by Martínez-Ortí &

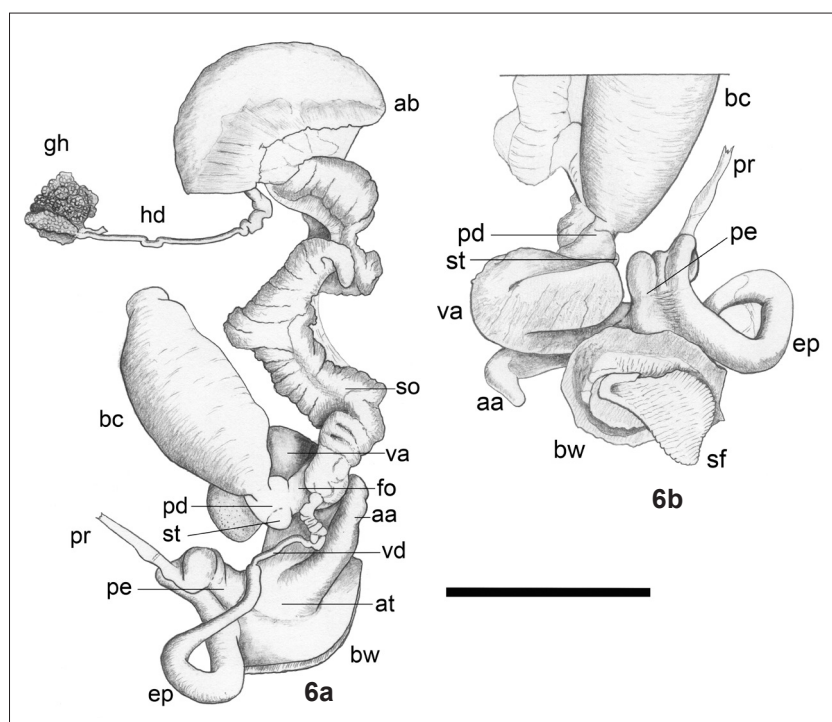


Fig. 6a. Dorsal view of the genital system of *Drusia valenciennii*, adult slug after one year of raising. **6b.** Ventral view of a detail of the genital system (drawings: C. Margry). aa = atrial appendix, ab = albumen gland, at = atrium, bc = bursa copulatrix, bw = body wall, ep = epiphallus, fo = free oviduct, gh = hermaphroditic gland, hd = hermaphrodite duct, pd = pedunculus (ductus bursa copulatrix), pe = penis, pr = penial retractor, sf = stimulator fold of the atrium, so = spermo-viduct, st = spherical thickening, va = vagina, vd = vas deferens. Scale bar 10 mm.

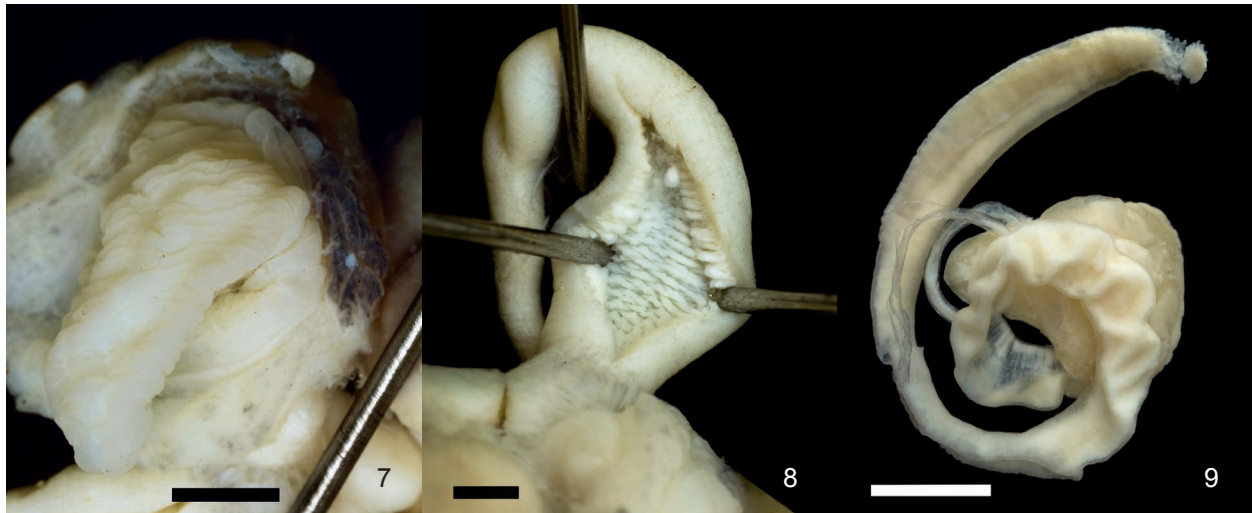


Fig. 7-9. *Drusia valenciennii*, adult slug after one year of raising (photos: I. Margry-Moonen). **7.** The pleated stimulator fold, bulged through the genital pore. Scale bar = 2 mm. **8.** Interior of the epiphallus showing the rows of parallel folds. Scale bar = 1 mm. **9.** Spermatophore. Scale bar = 2 mm.

Borredà (2013) to confirm the species as *D. valenciennii* (Webb & Van Beneden, 1836). Species from the subgenus *Escutiella* Martínez-Ortí & Borredà, 2012 are uniform in colour, have only small lines on the mantle and have a reticulated interior of the epiphallus (Martínez-Ortí & Borredà 2012), instead of parallel folds as in our specimen. Also, the central tooth of the radula has no deep notch in the base (Fig 11c). *Drusia tenerifensis* (Alonso, Ibáñez & Diaz, 1985) has a relatively wider shell, as shown by Alonso et al. (1985: figs 2, 22). Although the genitalia are very similar to the images of *D. ibera* (Eichwald, 1841) by Forcart (1959: figs 3, 4), *D. ibera* could be excluded because it does not have a pleated stimulator fold.

The dissected specimen will be deposited in the collection of Naturalis Biodiversity Center, Leiden, the Netherlands.

DISCUSSION

Drusia valenciennii is known from south-western Spain and Portugal (Martínez-Ortí & Borredà, 2013; Cadevall & Orozco, 2016). However, *Parmacella gervaisii* Moquin-Tandon, 1850, described from la Crau near Arles, France, was assumed by Welter-Schultes (2012) to be the same species as *D. valenciennii*, which he mapped as occurring through eastern Spain to the south of France (in a lighter shade to reinforce his assumption). Falkner et al. (2002) summarized the taxonomy of *P. gervaisii* and concluded that its taxonomic status is unclear, but that it seems to be most similar to a *Parmacella* from North Africa. Until 2014, *Parmacella* was not been found in France since the 19th century (Falkner et al., 2002; Welter-Schultes, 2012, Audibert & Ber-

trand, 2015). However, in 2014, both *Drusia (Drusia) valenciennii* and *Drusia (Escutiella) deshayesii* (Moquin-Tandon, 1848) were recorded in the west of the Aude district in the south of France (Bertrand, 2015).

Alonso et al. (1985) thought it possible that only the larger atrial appendix is visible if, because of fixation, the evagination of the atrium has progressed. It may be that the small appendix is still present but not visible. On the other hand, Martínez-Ortí & Borredà (2013) indicated that only one appendix is present in some *D. valenciennii*.

The discovery of *D. valenciennii* in Santpoort is not only new to the Netherlands but also the first record in north-western Europe. It is still uncertain that the population of this exotic species will survive in this temperate climate, and we advise that monitoring of this population is continued.

We suggest “Iberische bochelslak” as the Dutch common name for *D. valenciennii*. “Iberische” refers to the native origin and “bochel” refers to the shape of the body where there is a bend towards the tail side. This name fits in with the system of de Bruyne et al. (2015).

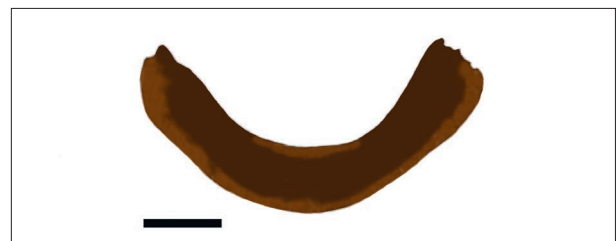


Fig. 10. Jaw of *Drusia valenciennii*, adult slug after one year of raising (drawing: C. Margry). Scale bar = 1 mm.

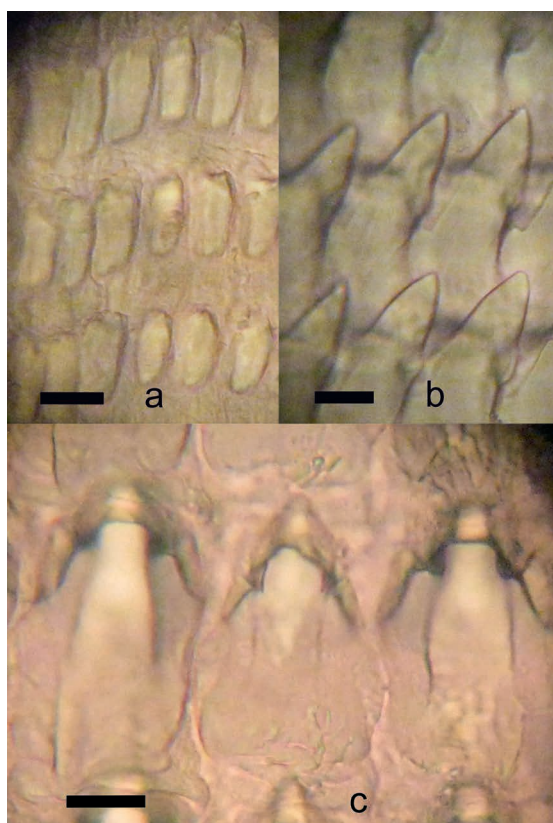


Fig. 11. *Drusia valenciennii*, adult slug after one year of raising, parts of the radula (photos: C. Margry). **11a.** Undeveloped marginal teeth. **11b.** Marginal teeth. **11c.** Central tooth, showing the meso- and ectocones and the absence of a deep notch. Scale bars = 20 µm.

ACKNOWLEDGEMENTS

We thank Rykel de Bruyne for his help with the search for more specimens and with the publication of the new exotic species. We also thank Joop Eikenboom for providing literature, Ingrid Margry-Moonen for taking the photographs, and Robert Forsyth for correcting our English and his helpful suggestions regarding the text.

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