Sellaphora temporalis sp. nov., *Sellaphora catalonica* sp. nov., and *Nitzschia curvirecta* sp. nov.: Three new diatoms (Bacillariophyta) from disconnected pools in the Iberian Peninsula

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Abstract: Disconnected pools are temporary habitats of great ecological importance that can maintain high aquatic biodiversity. However, little is known about the composition and distribution of algal communities in the Mediterranean basin. During a diatom flora study conducted on the Iberian Peninsula, several populations of unknown taxa were found. Detailed observations with optical and scanning electron microscopes allowed for the description of three new taxa to science: *Sellaphora temporalis* sp. nov., *Sellaphora catalonica* sp. nov., and *Nitzschia curvirecta* sp. nov. Differential diagnostic criteria with respect to similar taxa are briefly described, and ecological information is provided. All of this highlights the importance of disconnected Mediterranean pools, often overlooked in terms of conservation.

Keywords: Bacillariophyta, diatoms, disconnected pools, Iberian Peninsula, new species, temporary rivers

Introduction

Temporary rivers are highly dynamic aquatic ecosystems characterized by the recurrent interruption of their flow (Datry et al. 2013). These systems are distributed globally and represent the most common type of river in the Mediterranean basin (Larned et al. 2010). Their distinctive hydrological variability allows the identification of three main aquatic phases: the flow phase, the dry phase, and the pool phase (Gallart et al. 2012). During the flow phase, water circulates through the river channel, ensuring connectivity between sections. When the flow decreases, many rivers dry out completely, transitioning into the dry phase (Bonada et al. 2020). This allows the gradual colonization of the dry riverbed by adjacent terrestrial fauna and vegetation (Bogan et al. 2017). The pool phase lies between these two states, defined by isolated water bodies that can either dry out or reconnect depending on environmental conditions. Although these pools originate from lotic systems, they are highly dynamic lentic environments that host great environmental heterogeneity (e.g., temperature, pH, or dissolved oxygen) (Boulton 2003; Bonada et al. 2020; Sarremejane

et al. 2021). Therefore, pools play a crucial ecological role, acting as temporary transitional habitats capable of sustaining aquatic communities during periods of flow absence (Bonada et al. 2024).

Disconnected pools are considered an important resource for the diversity of aquatic diatom communities (Robson et al. 2008; Sabater et al. 2016; Quevedo–Ortiz et al. 2014). This is due to their role as both refuges and sources of propagules (Davis 1972; Robson et al. 2008; Bogan et al. 2017). Many diatom species appear to be well–adapted to these environments, showing a remarkable ability to withstand different hydrological fluctuations (Quevedo–Ortiz et al. 2024). However, few studies have addressed the actual biodiversity of diatoms in these temporary habitats. In fact, most research on continental aquatic algae in Spain tends to adopt an ecological approach, with detailed taxonomic identification often overlooked (Fanés et al. 2009). This gap is particularly relevant given that the Iberian Peninsula is one of the most diverse and heterogeneous regions in Europe in terms of habitats (Peinado et al. 2017).

The present study was conducted in disconnected pools in Spain, with the aim of contributing to the taxonomic investigation of the Mediterranean diatom

flora of the Iberian Peninsula. We present the morphological descriptions of three new taxa to science, based on illustrations from light microscopy and scanning electron microscopy. Finally, we provide information on the distribution and ecology of these new species.

MATERIALS AND METHODS

From May to July 2023, benthic diatom samples were collected from 65 disconnected pools in the Mediterranean bioclimatic zone of Spain (northeastern, central, and southern Iberian Peninsula). In five of these pools, located in Extremadura, Catalonia, and the Region of Murcia, populations of three previously unknown diatom species were found (Table 1, Fig. 1). The samples were collected by scraping seven submerged stones (approx. 15 cm²) with the help of a toothbrush. All collected material was preserved in 96% ethanol in 50 ml Falcon tubes and stored in refrigerators. Additionally, a water sample was collected for nutrient analysis and various physico–chemical variables were recorded in situ using a multiparameter probe (YSI Professional plus Multiparameter Probe): water temperature (°C), pH, dissolved oxygen (mg.l^{-1}), oxygen saturation (%), conductivity (EC µS.cm^{-1}) (Table 1).

All diatom samples were treated in the laboratory with hydrogen peroxide (33%) in a sand bath at 90 °C to remove organic matter. Drops of hydrochloric acid were added to remove calcium carbonate inclusions. After two days, the samples were allowed to settle and were washed with distilled water, discarding the supernatant on two occasions. A portion of each sample was dried on a glass slide and subsequently mounted with Naphrax© resin. The samples were observed under a Zeiss Polyvar microscope at ×1000 magnification (1.30 numerical aperture) with Differential Interference Contrast (DIC) and a digital camera. All photographs were taken using a 100× objective with immersion oil and assembled using Adobe Photoshop. Due to the large size of some specimens (specifically *Nitzschia curvirecta* sp. nov.), several photographs had to be taken and later manually stitched together.

Taxonomic identification was carried out at the species level using various online publications and diatom monographs, including KRAMMER & LANGE–BERTALOT (1986, 1988, 1991), LANGE–BERTALOT (2001), and HOFMANN et al. (2011). For frustule dimensions (length, width, stria density, and number of fibulae), the minimum and maximum values were indicated, as well as the mean value and standard deviation, given in parentheses. The relative abundance of each species (%) was also calculated based on counts of 400 valves per sample.

Another fraction of the treated sample was used for analysis in the scanning electron microscope. For this, several drops were placed on a coverslip attached to the sample holder of the scanning electron microscope using a conductive adhesive disk (carbon tape, Ted Pella). The samples were left to dry for a minimum of 24 hours. Subsequently, they were coated with a thin layer of gold to improve electronic conductivity. The resulting samples were observed in the scanning electron microscope (SEM) JSM–7001F (Jeol) (acceleration voltage of 15 kV) in the Electron Microscopy Unit TEM–SEM of the Scientific and Technological Centers (CCiTUB) of the University of Barcelona (Spain). Finally, for each species, one Naphrax slide and another preserved in alcohol were deposited in the BCN herbarium index, University of Barcelona (more details in the label of each holotype).

Table 1. Characterization of the disconnected pools where the new species were collected: *Sellaphora temporalis* sp. nov. was found in Río Zapatón and Arroyo de Barbaón (Extremadura), *Sellaphora catalonica* sp. nov. in Torrent de Ca l'Arenes (Catalonia), and *Nitzschia curvirecta* sp. nov. in Rambla de los Serrano and Rambla del Puerto de la Cadena (Region of Murcia).

Site	Coordinates	Water Temperature (°C)	pH	Oxygen (mg.l^{-1})	Conductivity (µS.cm^{-1})	Chloride (mg Cl$^-$.l^{-1})	Sulfate (mg SO$_4^{2-}$.l^{-1})	Phosphate (mg PO$_4^{3-}$.l^{-1})	Nitrite (mg NO$_2^-$.l^{-1})	Ammonium (mg NH$_4^+$.l^{-1})
Río Zapatón	39°17'49.7" N 6°49'01.7" W	29.53	8.43	11.15	212	14.18	11.86	0.006	0.005	0.06
Arroyo de Barbaón	39°51'43.2" N 6°04'38.6" W	21.47	7.12	3.38	95	8.50	4.74	0.122	0	0.06
Torrent de Ca l'Arenes	41°38'00.6" N 2°27'15.4" E	14.70	6.76	0.47	623	76.57	40.32	0.003	0.010	0.05
Rambla de los Serrano	37°56'25.2" N 1°04'17.7" W	26.41	8.37	7.4	39400	7231.80	19511.98	0.049	0.002	2
Rambla del Puerto de la Cadena	37°54'28.5" N 1°09'42.3" W	29.3	7.79	4.63	3235	272.25	1252.56	0.006	0.003	0.08

Results

Sellaphora temporalis G. Quevedo–Ortiz, Gomà et S. Blanco sp. nov. (Figs 2–23)

Description

LM (Figs 2–16): Valves elliptic–lanceolate with protracted subcapitate rounded apices. Valve dimensions: length 9.2–14.5 µm (11.4 ± 1.1 µm, n = 36), width: 3.5–4.1 µm (3.9 ± 0.1 µm, n = 36). Raphe filiform, with distinct central fissures. The axial area linear and narrow, slightly expanded towards the central area. Striae and areolae indiscernible.

SEM (Figs 17–23): Externally, valves flat (Figs 17, 19). Centrally, raphe expanded externally and slightly deflected towards the primary side (Fig. 20). Terminal fissures clearly deflected towards the mantle in the opposite direction to the central terminations (Fig. 22). Internally, proximal raphe fissures positioned within a raised, teardrop–shaped node (Figs 18, 21). The raphe fissures end at the poles in small elevated helictoglossae (Fig. 23). Central area moderately expanded due to the shortening and curvature of the central striae, 4–6 particularly short. Striae uniseriate, radiate in the center, becoming convergent towards the poles. The stria density is 36–40 in 10 µm (37.5 ± 1.2, n = 29). Each stria is composed of 8–12 circular or square areolae, reducing to 1–5 at the apices. Areolas near the sternum are larger than the others or partially fused with adjacent ones. Internally, areolas are occluded by hymenes.

Holotype: Naphrax slide BCN–Phyc 13739 (Plant Biodiversity Resource Centre, University of Barcelona, Barcelona, Spain). Another sample preserved in alcohol has been deposited.

Type locality: Río Zapatón (Badajoz, Extremadura), Spain, 39°17'49.7" N, 6°49'01.7" W. Date: July 19, 2023.

Habitat: Epilithon of disconnected pools from temporary rivers.

Etymology: The name of the species refers to the temporality of the habitat.

Ecology: The disconnected pools where *Sellaphora temporalis* was found were characterized by a high or relatively high water temperature, a slightly alkaline pH, and low nutrient concentrations. However, conductivity, oxygen, and sulfate levels showed high variability between the two pools (see Table 1 for more details).

Distribution: So far, *S. temporalis* has been recorded at two locations in the central–southern Iberian Peninsula (Extremadura, Spain). The first one, with a relative abundance of 4.0%, was found in a disconnected pool from Río Zapatón (Province of Badajoz). The second, with a relative abundance of 0.2%, was observed in a disconnected pool from Arroyo de Barbaón (Province of Cáceres). Both areas have a siliceous geology and a Mediterranean climate.

Similar taxa: *Sellaphora temporalis* presents a unique combination of characteristics that allows differentiation from other related taxa. The morphologically closest species is *Sellaphora vincentiana* Alibert et al. *S. vincentiana* was recently discovered in two oligotrophic lakes in the subarctic boreal zone of Tursujuq National Park (Quebec, Canada), with similar abundances (4.6%–0.6%) (ALIBERT et al. 2023). The smaller speci-

Río Zapatón

Torrent de Ca l'Arenes
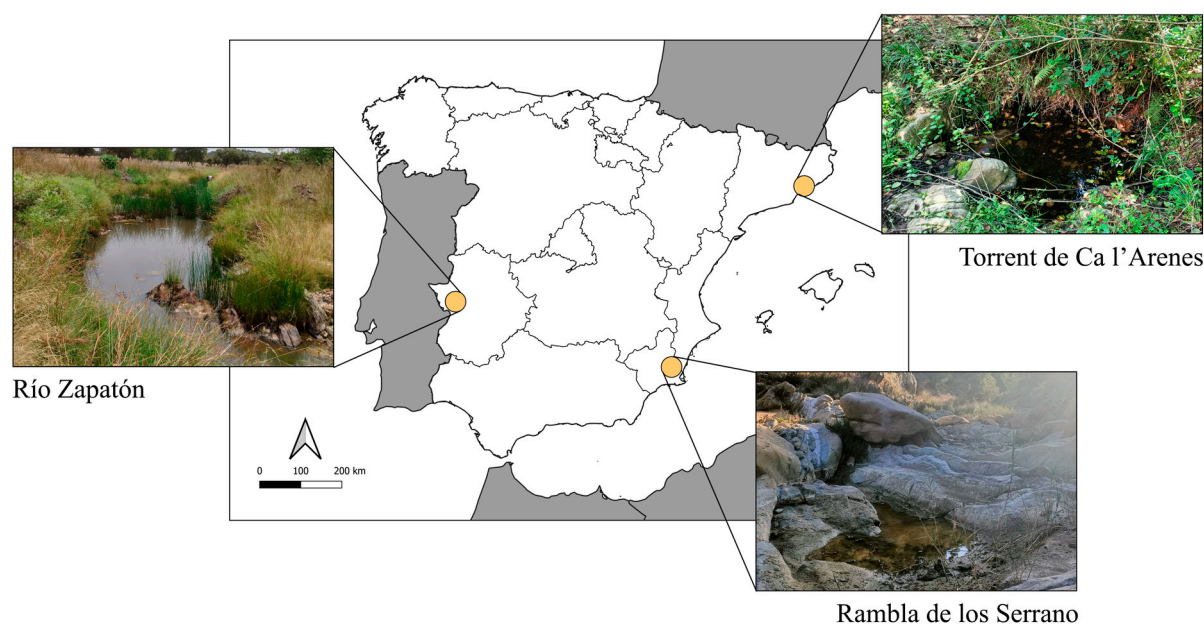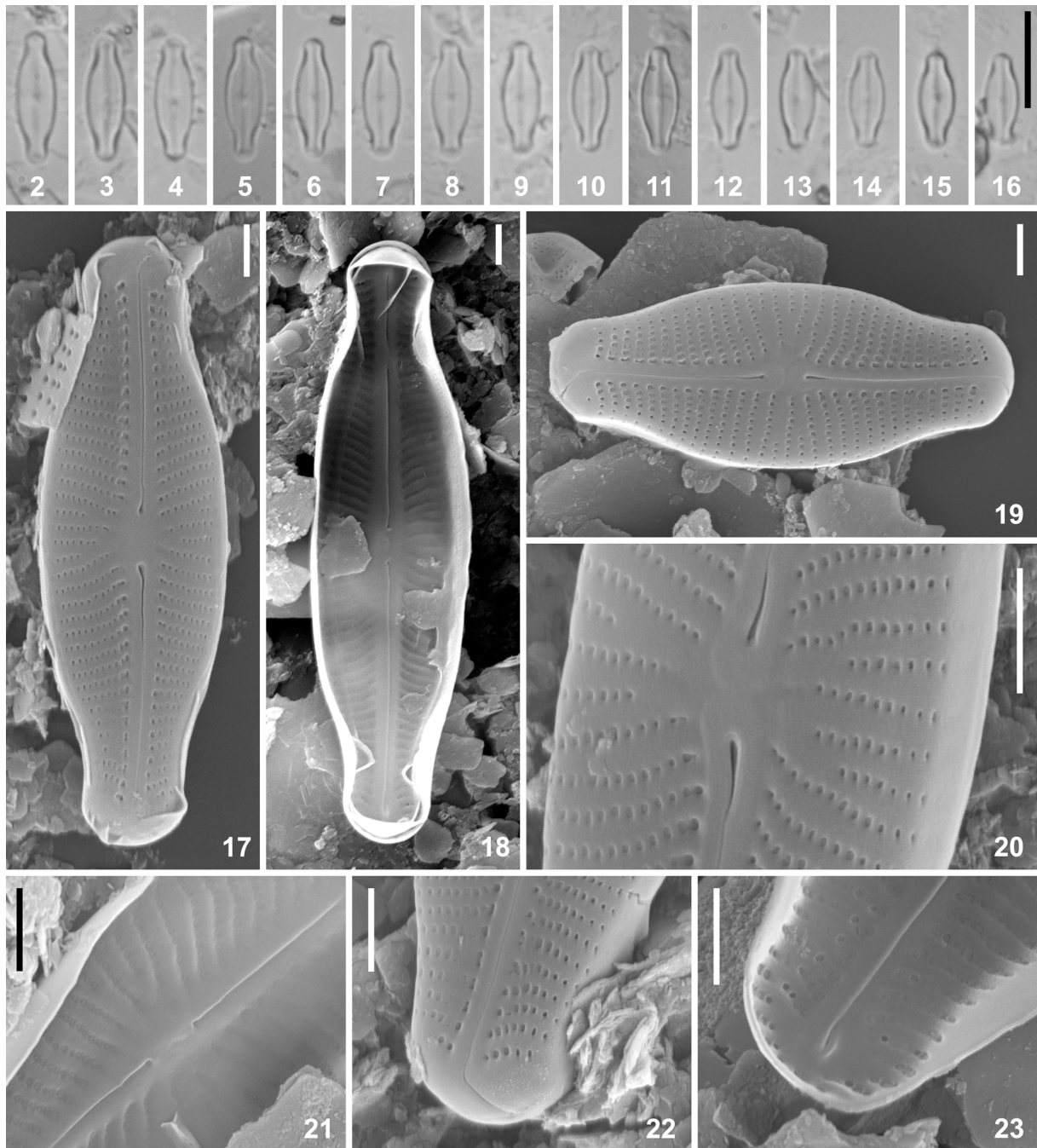
Rambla de los Serrano

Fig. 1. Map of Spain showing the locations of disconnected pools where each new species was found (holotype localities): *Sellaphora temporalis* sp. nov. in Río Zapatón (Extremadura), *Sellaphora catalonica* sp. nov. in Torrent de Ca l'Arenes (Catalonia), and *Nitzschia curvirecta* sp. nov. in Rambla de los Serrano (Region of Murcia).

Figs 2–23. *Sellaphora temporalis* sp. nov. (holotype): (2–16) LM valve views in a diminution series; (17, 19) SEM external views of the entire valve; (18) SEM internal view of the entire valve; (20) SEM external view of the central area; (21) SEM internal view of the central area; (22) SEM external view of the apex; (23) SEM internal view of the apex. Scale bars 10 µm (2–16); 1 µm (17–23).

mens of *S. vincentiana* may exhibit an outline similar to that of *S. temporalis*. However, *S. vincentiana* has a much broader size range [length: 8.0–18.5 µm, width: 2.5–4.5 µm], a higher stria density [49–51 in 10 µm], and different size and number of areolae [8–10 in 10 µm]. Additionally, the apical capitation is more pronounced in *S. temporalis*. Another similar species is *Sellaphora davoutiana* Heudre et al. Although this species may appear similar under the scanning electron microscope (HEUDRE et al. 2018), its striae are easily visible under light microscopy (LM). Moreover, both the size of the areolae and the valve width are considerably larger, the latter ranging between 4.0 and 4.9 µm. Other less similar species are *Navicula arvensoides* Hustedt and *Sellaphora pseudoarvensis* (Hustedt) C.E. Wetzel et Ector. Both species are clearly distinguished by their different length–to–width ratios, with a much narrower size range [length: 10, width: 4 µm for *Navicula arvensoides*; length: 8–10, width: 3 µm for *S. pseudoarvensis*] (ALIBERT et al. 2023).

Sellaphora catalonica G. Quevedo–Ortiz, Gomà et S. Blanco sp. nov. (Figs 24–45)

Description

LM (Figs 24–38): Valves rhombic–lanceolate to elliptic–lanceolate with strongly elongated and rounded capitate a-pices. Valve dimensions: length 14–18.6 μm (17.4 ± 1.1 μm, n = 15), width: 3.4–4.4 μm (4.2 ± 0.2 μm, n = 15). Raphe straight and filiform, featuring distinct central fissures. Axial area linear and narrow. Central area rectangular, with short striae that are weakly defined. The remaining striae barely perceptible, especially towards the apices.

SEM (Figs 39–45): Externally, valves flat with an elevated sternum (Figs 39, 41). Central fissures small and very slightly deflected toward the primary side (Fig. 42). The expanded central area is surrounded by 6–10 very short striae that usually alternate in length (Fig. 42). Terminal fissures are clearly deflected towards the mantle in the opposite direction to the central terminations (Fig. 44).
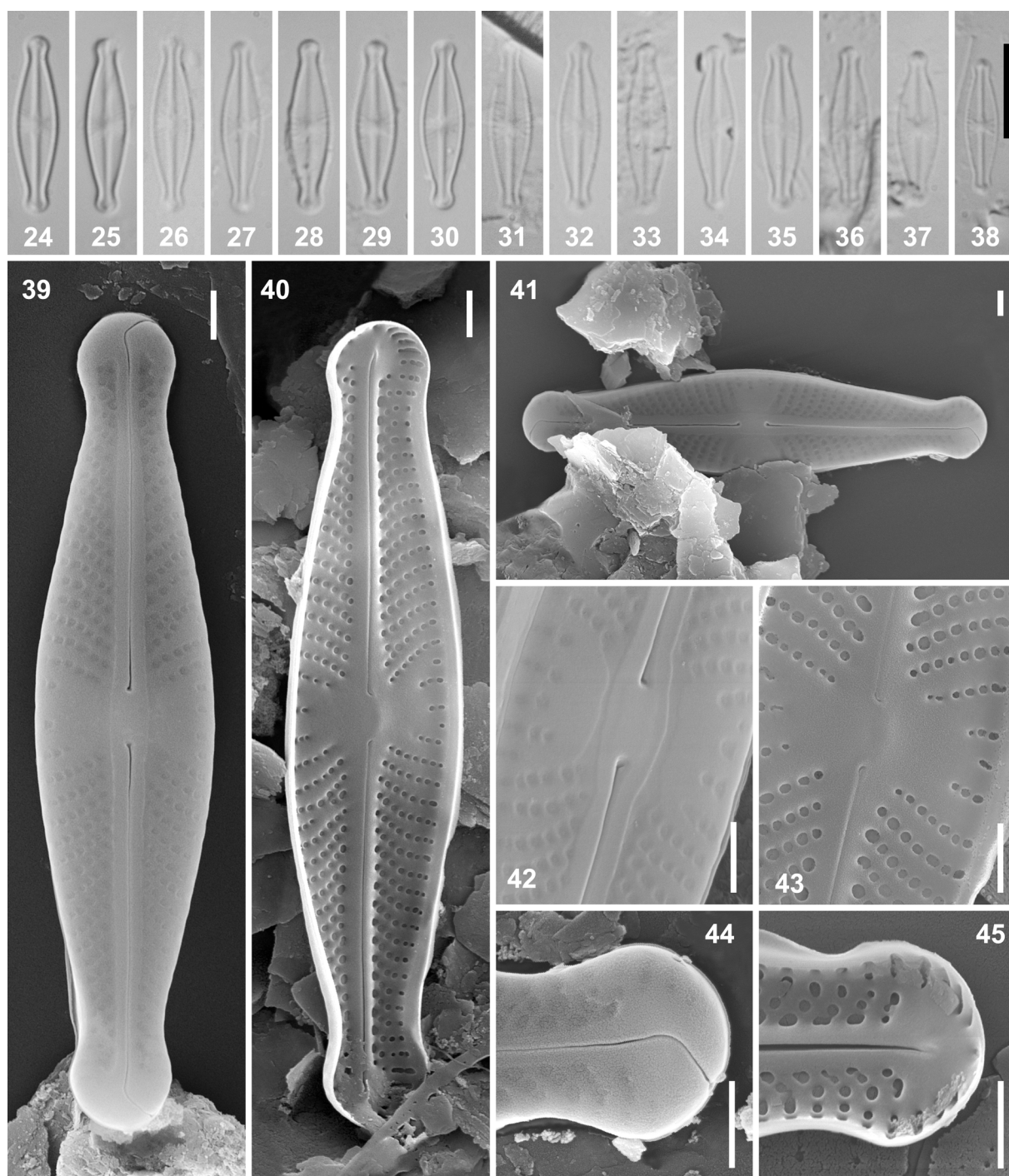
Figs 24–45. *Sellaphora catalonica* sp. nov. (holotype): (24–38) LM valve views in a diminution series; (39, 41) SEM external views of the entire valve; (40) SEM internal view of the entire valve; (42) SEM external view of the central area; (43) SEM internal view of the central area; (44) SEM external view of the apex; (45) SEM internal view of the apex. Scale bars 10 μm (24–38); 1 μm (39–45).

Internally, the proximal raphe fissures are bent and positioned within a raised node (Figs 40, 43). The raphe fissures end in small elevated helictoglossae (Fig. 45). The striae are uniseriate and radiate, with a density of 24–29 in 10 μm (26.5 ± 1.5, n = 11). The striae are composed of large, circular areolae that appear shallow externally due to hymenes occluding their apertures; however, in internal view, the areolae are distinctly deep, reflecting their true structural depth beneath the hymenal coverings. There are 6–8 areolae per stria, decreasing to 3–4 at the apices and 1–3 in the central area.

Holotype: Naphrax slide BCN–Phyc 13740 (Plant Biodiversity Resource Centre, University of Barcelona, Barcelona, Spain). Another sample preserved in alcohol has been deposited.

Type locality: Torrent de Ca l'Arenes (Barcelona, Catalonia), Spain, 41°38'00.6" N, 2°27'15.4" E. Date: June 2, 2023.

Habitat: Epilithon of disconnected pools from temporary rivers.

Etymology: The name refers to the area where it was found.

Ecology: The disconnected pool where *Sellaphora catalonica* was found was characterized by relatively low water temperature and a slightly acidic pH. The conductivity values and the concentrations of chlorides and sulfates were quite high. In contrast, the oxygen levels and the remaining nutrients were low (see Table 1 for more details).

Distribution: So far, *S. catalonica* has been recorded at a single location in the northeastern Iberian Peninsula (Catalonia, Spain), specifically in Torrent de Ca l'Arenes (Province of Barcelona), with a relative abundance of 0.4%. This area is characterized by siliceous geology and a Temperate–Mediterranean climate.

Similar taxa: *Sellaphora catalonica* presents a unique combination of characteristics that distinguish it from other related taxa. For instance, *Sellaphora japonica* (H. Kobayasi) H. Kobayasi exhibits a similar appearance due to the strongly capitate apices (KOBAYASI & MAYAMA 1986). However, it can be easily differentiated by its larger size [length: 13–24.5 μm, width: 5.4–6.1 μm]. *S. catalonica* also shares similarities with *Sellaphora subfasciata* M. Potapova. Although *S. subfasciata* has a lower range of stria density [26–28 in 10 μm], it exhibits very similar dimensions [length: 14–18 μm, width: 3.6–4.5 μm] (POTAPOVA 2013). *S. catalonica* differs from *S. subfasciata* by its more elongated head, a rhombic shape, a distinct length/width ratio, indistinguishable striae under LM, and larger, less distinct areolae under SEM. Additionally, the central area of *S. catalonica* is composed of fewer and shorter striae. *Sellaphora pulchra* Enache et Potapova is a smaller species [length: 7.6–13.3 μm, width 3.3–4.0 μm] compared to *S. catalonica*, and also has striae that are difficult to observe under LM. In SEM, the number of areolae and striae [35–45 per 10 μm] is considerably higher (ENACHE & POTAPOVA 2009). *Sellaphora disjuncta* (Hustedt) D.G. Mann can also resemble *S. catalonica*. This species also shows a clear elongation of its apices, but it is much less capitate. Furthermore, it has a greater length [16–18 μm] and width range [4–5 μm] (MANN 1989). Although it exhibits a similar striation density [23–28 in 10 μm], the striae are strongly visible and well–defined under LM. Other species that are less similar include *Sellaphora schadei* (Krasske) Wetzel et al. and *Sellaphora javanica* Wetzel. In both cases, the striae are clearly visible under LM, with scarcely elongated apices and a greater width [4.8–5.6 μm for *S. schadei* and 4.3–5.5 μm for *S. javanica*] (HUSTEDT 1937; WETZEL et al. 2015).

***Nitzschia curvirecta* G. Quevedo–Ortiz, Gomà et S. Blanco sp. nov. (Figs 46–73)**
Description
LM (Figs 46–60): Frustules straight, linear, and elongated, with straight and rounded apices in valve view (Figs 46–53). Sigmoid shaped in girdle view (Fig. 54). This curvature causes a distinct segmented blur in valve view (Figs 55–57). The slight sigmoid shape observed in some specimens in valve view is caused by the inclination of the frustule on an irregular surface (e.g. Fig. 47). Valve dimensions: length 183.3–333.3 μm (293 ± 39.3 μm, n = 16), width: 7.5–9.3 μm (8.3 ± 0.5 μm, n = 16). Raphe canal straight, eccentric, and interrupted at the center. Striae fine and difficult to resolve. Marginal fibulae number 6–8 in 10 μm (6.5 ± 0.8, n = 16), and can be easily observed across the entire valve by adjusting the focus under the microscope (Figs 58–60).

SEM (Figs 61–73): Valves straight with rounded apices in valve view (Figs 67–68). The raphe canal eccentric between the valve and the mantle, with the proximal ends facing each other and slightly raised (Figs 61–63, 71). At the apices, the terminal fissure is short and curves sharply and does not extend toward the mantle (Fig. 69). Internally, the marginal raphe system is supported by fibulae of variable size (Figs 64–66). Each fibula is composed of 3–5 small ribs that fuse at the center to form a bridge over the raphe canal. At the central nodule, the proximal fissures of the raphe appear as a small double helictoglossa (Fig. 72). At the apices, the raphe fissures end in helicoglossae (Fig. 70). Striae are uniseriate and parallel, slightly radial at the apices (Figs 61–63, 69). The stria density is 30–35 in 10 μm (32 ± 1.5, n = 20), composed of small circular areolae. There are elliptical areolae located two rows away from the raphe due to the partial fusion of two or three areolae. Internally, the areolae vary from elliptical to circular, with hymenate occlusions. A sigmoid shape is observed in girdle view, due to the opposing inclination of the apices (Fig. 73).

Holotype: Naphrax slide BCN–Phyc 13741 (Plant Biodiversity Resource Centre, University of Barcelona, Barcelona, Spain). Another sample has been preserved in alcohol.
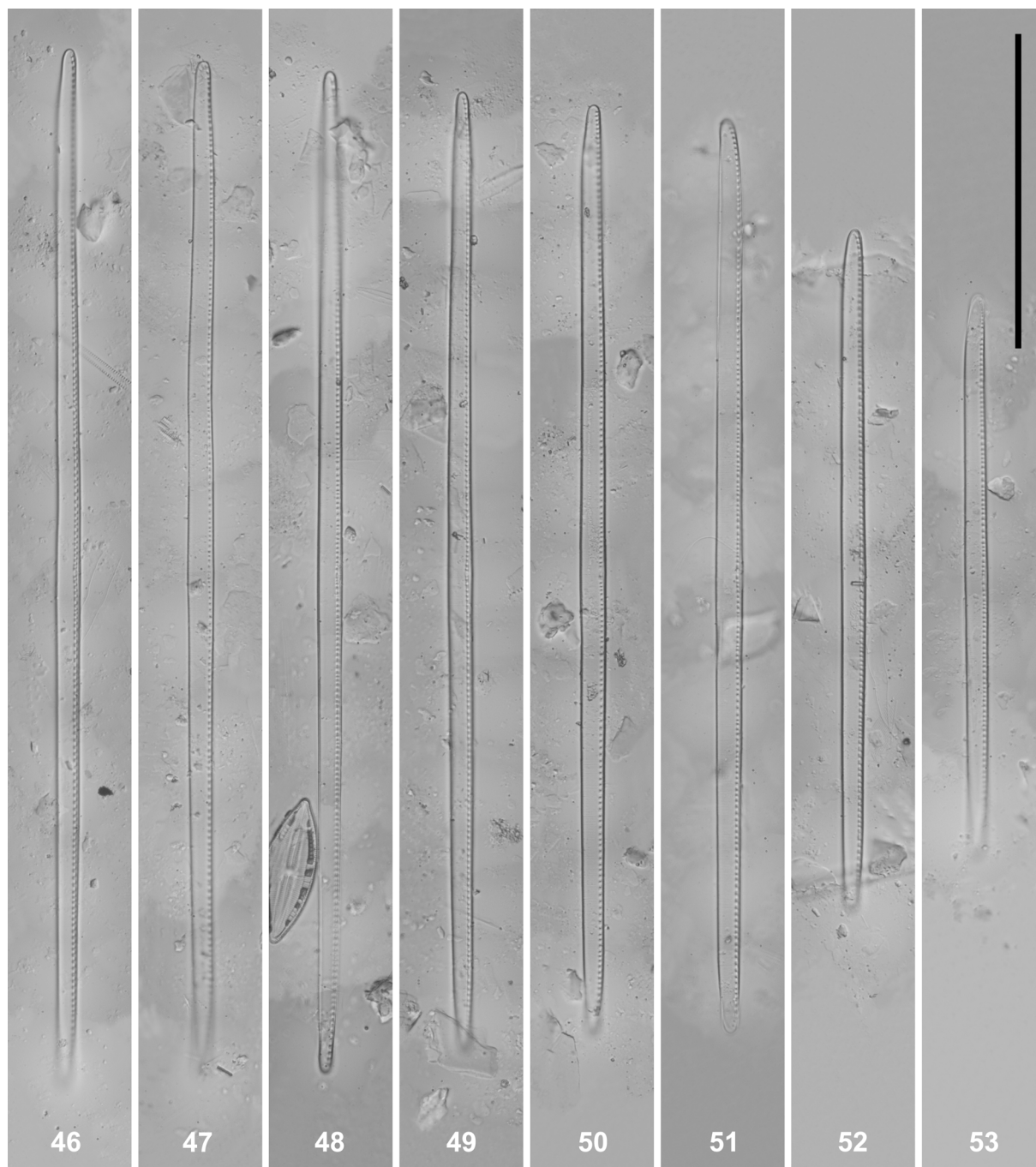
Figs 46–53. *Nitzschia curvirecta* sp. nov. (holotype): LM valve views in a diminution series. Scale bar 100 μm.

Type locality: Rambla de los Serrano (Region of Murcia), Spain, 37°56'25.2" N, 1°04'17.7" W. Date: May 8, 2023.

Habitat: Epilithon of disconnected pools from temporary rivers.

Etymology: The name refers to the morphology of frustule: straight in valve view and sigmoid in girdle view.

Ecology: The disconnected pools where *Nitzschia curvirecta* was found were characterized by high water temperatures and slightly acidic pH. Conductivity, chlorides, and sulfates were elevated in both pools, particularly in Rambla de los Serrano. These high recorded values are likely related to the elevated concentrations of salts commonly found in some watercourses of the Region of Murcia. Nitrite levels were high in Rambla de los Serrano, whereas the remaining nutrients were generally low in both pools (see Table 1 for more details).

Distribution: So far, *N. curvirecta* has been recorded at two locations in the southeastern Iberian Peninsula (Region of Murcia, Spain). The first one, with a relative abundance of 8.2%, was found in a disconnected pool from Rambla de los Serrano. The second, with a relative abundance of 0.2%, was observed in a disconnected pool from Rambla del Puerto de la Cadena. Both areas have a clayey, slightly siliceous geology and a Mediterranean climate.
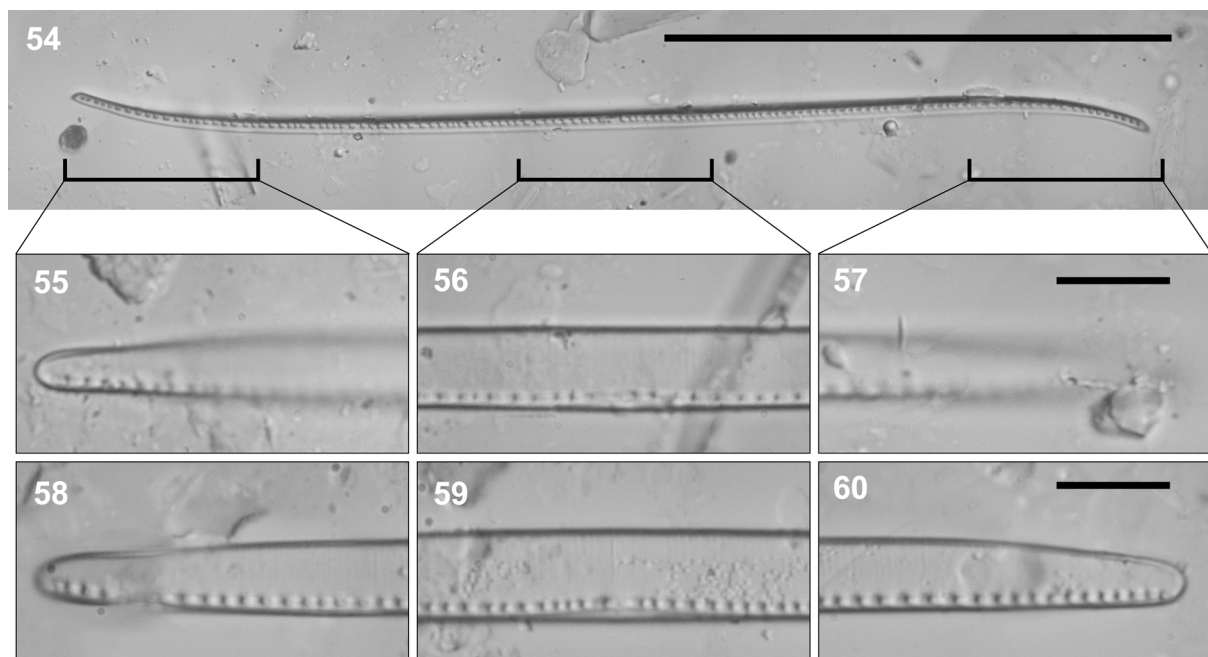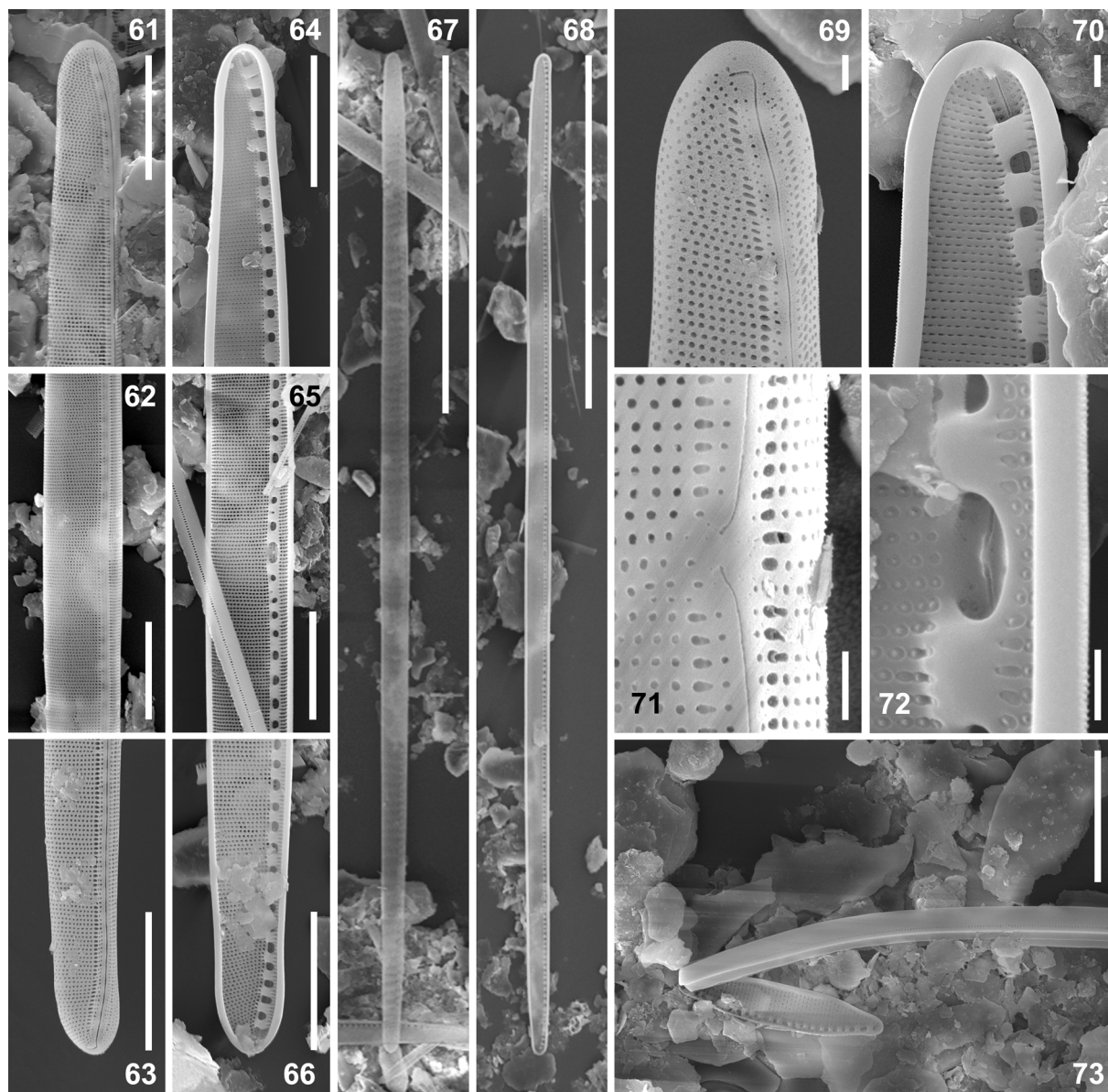
Figs 54–60. *Nitzschia curvirecta* sp. nov. (holotype): (54) LM girdle view; (55–57) LM valve views showing the blurring effect caused by the sigmoid curvature in girdle view; (58–60) LM valve views in which progressive manual focusing was applied across the entire valve. Scale bars 100 μm (54), 10 μm (55–60).

Similar taxa: *Nitzschia curvirecta* presents a unique combination of characteristics that distinguishes it from other related taxa. It exhibits a distinctive straight shape – in valve view – with rounded ends, distinguishing it from other members of the Obtusae section within *Nitzschia* Hassall (Bacillariophyceae). In girdle view, it displays a sigmoid shape that creates a pronounced blurring effect exclusively at the apices. The most morphologically similar species is clearly *Nitzschia obtusa*, with comparable dimensions. However, its shape is clearly sigmoid in valve view. *N. obtusa* also presents a lower number of fibulae (4–6 in 10 μm), larger areolae, and a higher stria density (>40 in 10 μm) (Hamsher et al. 2021). A particularly noteworthy feature of *Nitzschia curvirecta* is the complete absence of central fissures in the raphe system. This sets it apart not only from *N. obtusa* but also from the entire Obtusae group, which is generally characterized by the presence of long central fissures and an inflected raphe system, as documented by Hamsher et al. (2021) and illustrated in other works (e.g., Mann 1978; figs 865, 875, 881). To our knowledge, *N. curvirecta* is the first described member of the Obtusae group to entirely lack central fissures. This unique morphological trait raises intriguing questions about the evolutionary history of the group. It remains to be determined whether *N. curvirecta* represents an early–diverging lineage within the Obtusae – predating the evolution of central fissures – or whether it is a more derived member that has secondarily lost these structures. Resolving this issue will require future phylogenetic analyses incorporating both morphological and molecular data.

It is worth noting that there is an uncommon variety of *N. obtusa* with a morphology very similar to *N. curvirecta*. *Nitzschia obtusa* var. *recta* Berg is a diatom discovered on the east coast of Sweden in 1952. It is currently classified as uncertain and not evaluated according to DiatomBase (Kociolek et al. 2024). The original material is unavailable, with only one illustration by the author serving as a reference (Fig. 74) (Berg 1952, available in Potapova et al. 2025). *N. obtusa* var. *recta* was described as a long and straight diatom, with slightly rounded apices. However, Berg did not report the presence of a pronounced blurring effect toward the apices, nor a sigmoid shape in girdle view as seen in *N. curvirecta*. When comparing its size to *N. curvirecta* (length: 183.3–333.3 μm, width: 7.5–9.3 μm), both its length (100–275 μm) and width (7 μm) are smaller (Berg 1952). Stria density also differs, as Berg recorded 27–30 in 10 μm under LM. Like Hamsher et al. (2021) for *N. obtusa*, we were also unable to clearly observe the striae under LM. However, we determined 30–35 striae in 10 μm under SEM. Since the original description did not include SEM information, and no further records have been reported since its discovery, other characteristics could not be compared. Regarding their ecology, both samples were also obtained from markedly different habitats. While *N. obtusa* var. *recta* was collected from marine samples, *N. curvirecta* was found in disconnected pools. Although these pools showed high conductivity values, it is important to highlight that they originate from freshwater environments.

Despite the differences presented, the limited information available on *Nitzschia obtusa* var. *recta* (particularly from SEM) does not entirely rule out the pos-

Figs 61–73. *Nitzschia curvirecta* sp. nov. (holotype): (61, 63) SEM external views of the apex; (62) SEM external view of the central area; (64, 66) SEM internal views of the apex; (65) SEM internal view of the central area; (67) SEM external view of the entire valve; (68) SEM internal view of the entire valve; (69) SEM external view of the apex showing the raphe; (70) SEM internal view of the apex showing the raphe; (71) SEM external view of the central area, showing the proximal raphe ends; (72) SEM internal view of the central area, showing the proximal raphe ends terminating in a small double helictoglossa; (73) SEM girdle view of the apex. Scale bars 100 μm (67–68), 10 μm (61–66, 73); 1 μm (69–72).
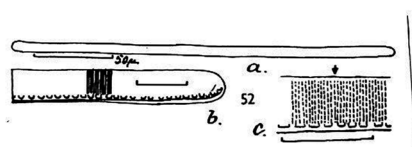

Fig. 74. Original drawing of *Nitzschia obtusa* var. *recta* from Berg (1952).

sibility that they represent heterotypic forms with wide morphological variability. In any case, this possibility would require reconsidering its status as a variety and assessing its elevation to the species level, in which case *Nitzschia curvirecta* would retain the assignment of the corresponding holotype. Therefore, further studies are needed to clarify these taxonomic uncertainties, possibly related to an unresolved species complex.

Other less similar species include *Nitzschia potapovae* Hamsher et al. and *Nitzschia lowei* Hamsher et al. Although the dimensions of *N. potapovae* are comparable (length: 182–346 μm, width: 7–10 μm), it differs in valve shape, stria density (20–22 in 10 μm), and raphe characteristics (similar to those of *N. obtusa*). *N. lowei* has a more linear and straight shape but is noticeably smaller in size (length: 119.6–182.8 μm, width: 6.6–9.8 μm) (Hamsher et al. 2021).

Discussion

The information provided in this study demonstrates the ecological importance of disconnected Mediterranean pools for the diatom flora, capable of harboring new taxa to science. As other authors have commented, these temporary habitats are capable of supporting a great diversity of aquatic life after the loss of water flow (Robson et al. 2008; Sabater et al. 2016). The pools function as refuges and propagule release zones until the watercourse reconnects or dries out completely (Bogan et al. 2017). This requires diatom communities to exhibit traits of resistance and resilience that allow them to cope with various disturbances, such as desiccation. For example, Quevedo–Ortiz et al. (2024) determined that species with high ecological plasticity (e.g., *Nitzschia palea* var. *debilis* (Kützing) Grunow), pioneer species, or small–sized species (e.g., *Achnanthidium minutissimum* (Kützing) Czarnecki) are common in these environments. Our results confirm that these highly dynamic environments can also harbor previously unknown diatom species. This contradicts the widespread belief that temporary pools only contain a limited number of taxa, often non–native. Although this perception has some basis, as the inevitable and recurring presence of cosmopolitan taxa can jeopardize rare, endemic, and unknown species (Williams et al. 2004; Reyes et al. 2007; Reyes et al. 2008), our findings demonstrate that these habitats can still sustain unique biodiversity. In any case, it is currently difficult to determine the possible endemicity of the species studied here. Therefore, further taxonomic studies are needed, involving a larger number of pools to better characterize their ecology and distribution.

Currently, there are very few studies available to compare with our results. However, it is important to highlight the contributions of Blanco et al. (2013) in the temporary ponds of Doñana (Spain). That study documented a remarkable specific richness of diatoms in temporary still waters, including the description of five new endemic taxa. The ecological similarity between both environments not only emphasizes the need to recognize their ecosystemic importance but also highlights the likely evolutionary role they play in their fauna and flora (Margalef 1983; Blanco et al. 2013). We consider it very important to publish all these morphological and distributional aspects to correctly characterize the autoecology of the different species. Therefore, publishing taxonomic studies based on the characterization of the environment can undoubtedly help estimate the true magnitude of endemism in diatoms, which appears to be a widely spread pattern (Vyverman et al. 1997; Sabbe 2001; Blanco et al. 2013).

This study represents a first approach to the detailed characterization of new diatom taxa from disconnected Mediterranean pools in the Iberian Peninsula. Further studies are needed to expand the taxonomic knowledge of these and other species from disconnected pools, which would help clarify their distribution and assess their potential endemicity. We consider it essential to gather ecological information about these temporary ecosystems, which are often overlooked in terms of floristic conservation.

Authorship contribution statement
Guillermo Quevedo–Ortiz: conceptualization, investigation, methodology, writing – original draft, review & editing; Joan Gomà: conceptualization, writing – review & editing; Saul Blanco: conceptualization, writing – review & editing.

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