Planothidium engelbrechtii (Cholnoky) Round & Bukhtiyarova: Identity and lectotypification (Bacillariophyta)

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Abstract: *Planothidium engelbrechtii* (Cholnoky) Round et Bukht. was originally described in 1955 from South Africa as *Achnanthes engelbrechtii* Cholnoky. It became necessary to revise the original type material because of some discrepancies between the original description and figures and the current allotment of this species to the genus *Planothidium*. The present study confirms the transfer of *A. engelbrechtii* to *Planothidium*. A lectotype is designated from Cholnoky's original material. Valves from the type material are illustrated and discussed by means of LM and SEM micrographs.

Key words: diatoms, *Achnanthes*, *Planothidium*, morphology, lectotypification, South Africa

Introduction

During several studies on diatoms from West African biotopes (Compère 1991, Compère & Riaux–Gobin 2009), a few specimens of an *Achnanthes* s.l. species resembling *A. engelbrechtii* Cholnoky were observed. When comparing these findings with the original description and illustration of Cholnoky (1955) as well as with later data published on one hand by Cholnoky (1959) and on the other hand by other South African authors (such as Schoeman & Ashton 1983), some differences could be noted, especially in the description of the striae. In the original paper (Cholnoky 1955), the striae were described as uniseriate, with ca 36 areolae (puncta) in 10 µm, which is not in agreement with the inclusion of this species in the genus *Planothidum*. According to the authors of *Planothidium*, Round & Bukhtiyarova (1996), the striae can be described as being "thick (i.e. bi–multiseriate in SEM)". However, in a later paper, Cholnoky (1959) illustrated the striae as relatively thick, with the individual puncta almost not resolvable in LM. On the other hand, in other observations from South Africa attributed to *Achnanthes engelbrechtii*, the striae were illustrated in TEM as composed of 2–3 rows of small pores (Schoeman & Ashton 1983).
In order to resolve this discrepancy and to establish the correct identity of *Achnanthes engelbrechtii*, we examined in LM some slides of Cholnoky's original material. Cleaned material from one of the original samples was afterwards used to study the ultrastructure of this species using the SEM.

Material and methods

We received the slides CSIR 326/6503 and 326/6504 from the collection A. Engelbrecht JO 3, July 1953 as well as cleaned material from the same collection. According to Cholnoky (1955: 13) *A. engelbrechtii* represented 15.8% of the diatom population in this sample. The slides were examined using an Olympus BX51 light microscope equipped with differential interference contrast (Nomarski) optics. For SEM observation, a drop of the cleaned sample was air–dried on an aluminium stub, sputter–coated with gold and studied in a JEOL–5800LV at 20 kV.
Terminology is based on Barber & Haworth (1981) and Round et al. (1990).

Observations of the type slide

LM Morphology (Figs 1–43)

Valves lanceolate to elliptic–lanceolate and even rhombic–lanceolate with broadly protracted, rounded apices. In some cases, valves tend to get

a more cymbelloid outline (e.g. Figs 21, 30, 41, 46, 47) due to a slight deformation of the valves. Valve dimensions (n = 25): length 8–19 µm, width 3.3–4.7 µm [dimensions given by CHOLNOKY (1955): length 8–18, width 3.5–5.5 µm]. Rapheless valve (RLV) (Figs 1–27): axial area very narrow, linear to linear-lanceolate. Central area absent or very weakly, asymmetrically enlarged due to the shortening of some of the striae in the middle of the valve. Transapical striae almost parallel to subparallel becoming more radiate towards the valve apices, 17–18 in 10 µm. Areolae not resolvable in LM. Raphe valve (RV) (Figs 28–43): axial area narrow, linear, forming a raised raphe-sternum. Central area slightly transapically expanded due to the shortening of the middle striae. Central nodule markedly present. Raphe filiform, straight with expanded, straight central raphe endings. Terminal raphe endings hardly observable, but with unilaterally deflected terminal fissures (Fig. 36, see arrow). Transapical striae weakly to moderately radiate becoming more radiate towards the valve apices, 16–18 in 10 µm. One stria in the central area shortened. Areolae not resolvable in LM.

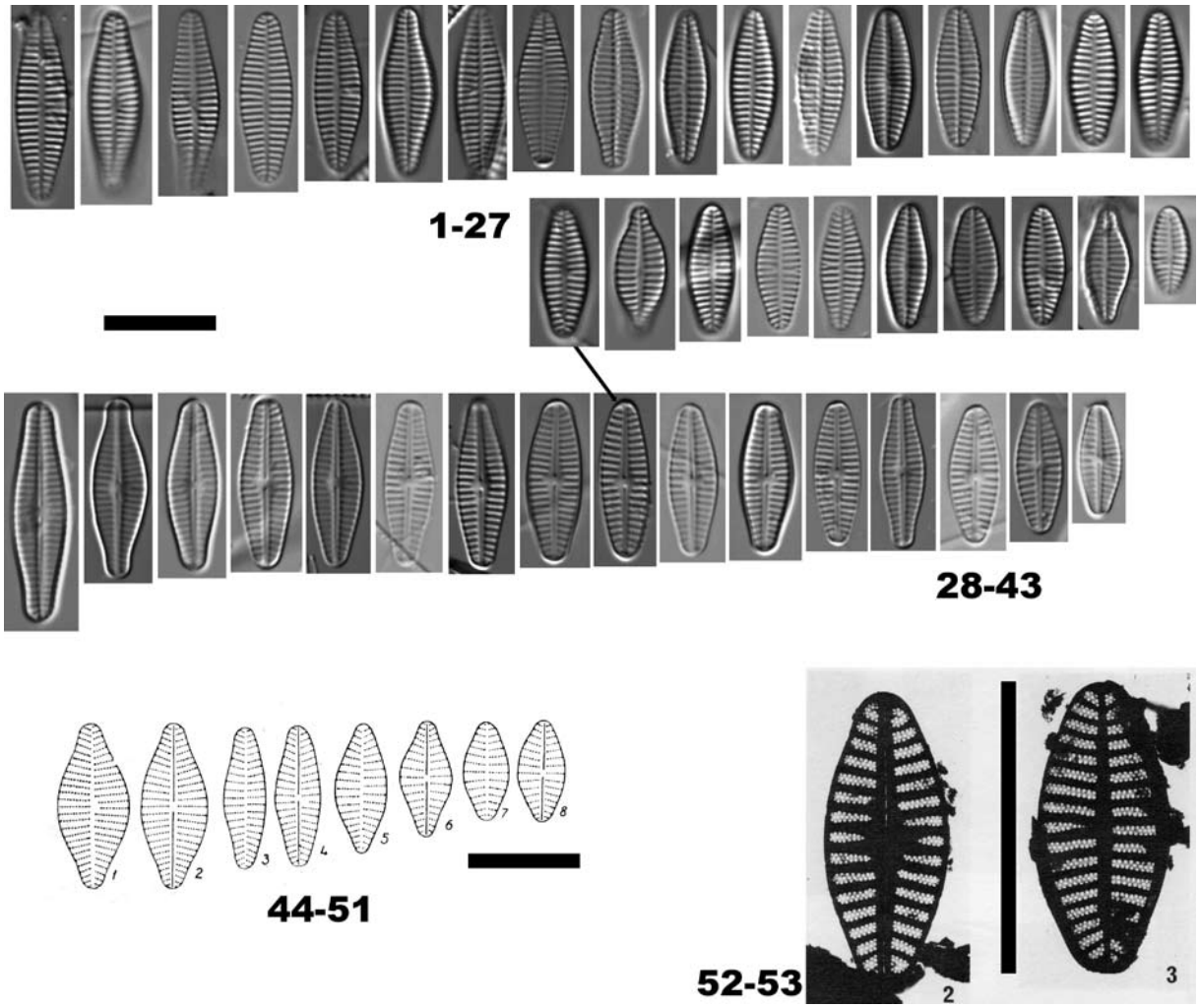
SEM morphology (Figs 54–61)

The ultrastructure of the raphe system and the striae becomes more clear using the SEM. RV (Figs 54, 56, 58, 60): transapical striae composed of 3 rows of small, rounded areolae with the largest areolae bordering the striae (Fig. 59, see arrow). Near the central area, striae showing an elongated triangular shape with a reduced number of rows of areolae near the valve centre (Figs 54, 56). Striae separated by raised ribs. In the central area, one very shortened stria present on one side whereas on the other side, striae tend to be less shortened. Towards the apices, striae apparently merging forming one large stria with 5–6 rows of areolae (Fig. 58). Terminal fissures unilaterally deflected (Fig. 54), continuing onto the valve mantle. Central raphe pores enlarged, straight, relatively close to each other. Internally, central raphe endings deflected into opposite directions near the large, rounded central nodule. Distal raphe endings terminating in small helictoglossae (Fig. 60). Areolae positioned between costae. RLV (Figs 55, 57, 59, 61): transapical striae composed of 3 but more often 4 series of rounded areolae (Figs 55, 57, 59). Striae located between slightly raised ribs (Fig. 57). Near the central area, one to several striae triangularly shaped with a reduced number of areolae rows (Fig. 55). Occasionally, a reduced number of areolae can also be seen near the apices (Fig. 55, see arrow). Internally, areolae positioned between costae (Fig. 61).

Discussion

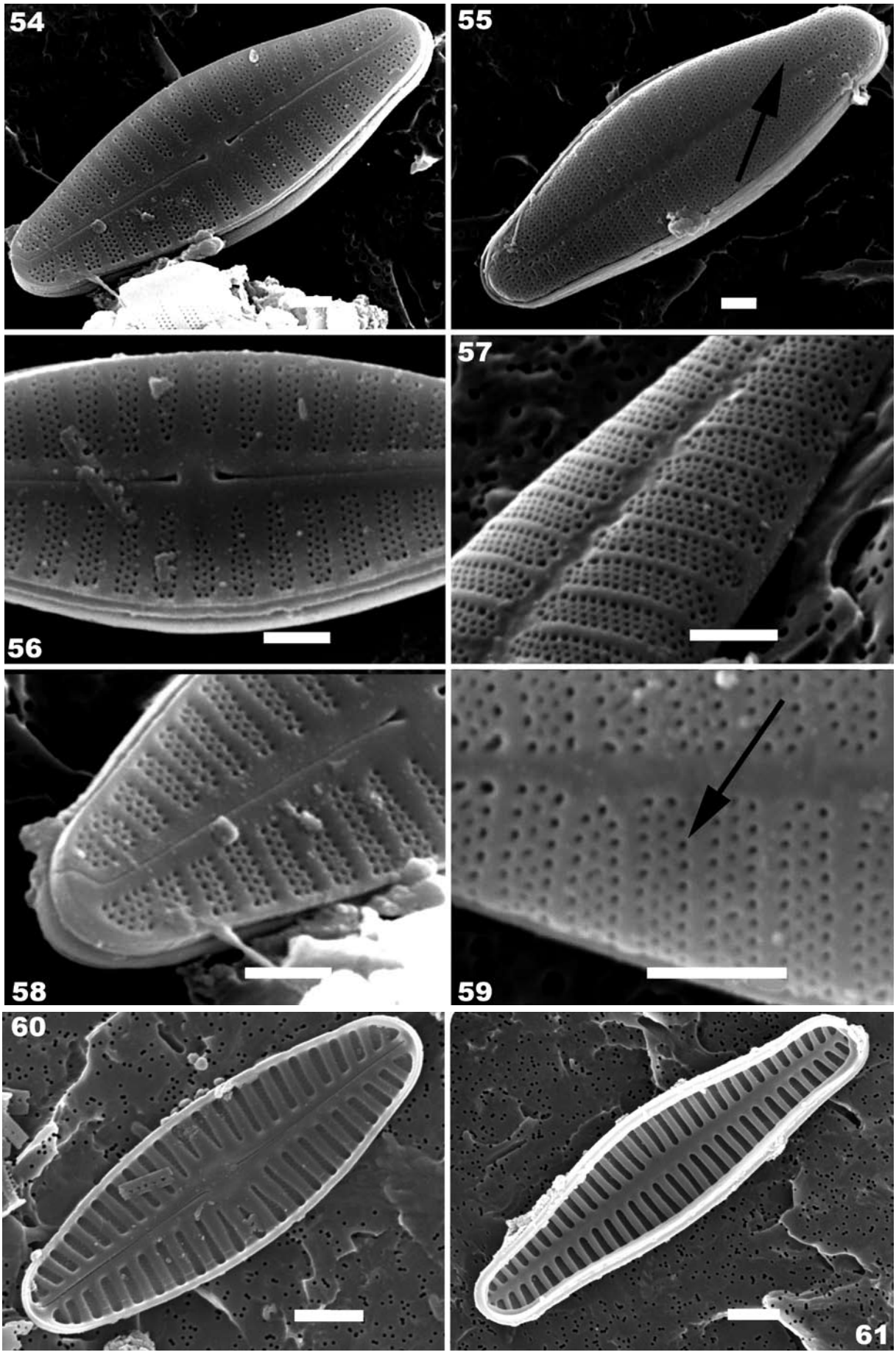
Under the light microscope, the observed valves match very well those described and illustrated by CHOLNOKY (1955) (Figs 44–51). Their dimensions correspond [8–19 x 3.3–4.7 µm vs 8–18 x 3.5–5.5 in the original description (figs 27, 43)] as well as the density of the striae (16–18 vs 15–17 in 10 µm). Two small individuals (8–10.3 x 3.7–4.2 µm; 18–20 str. in 10 µm) could belong to var. *minuta* CHOLNOKY (Figs 27, 43) but there are intermediate forms and we do not think that such a variety is worth maintaining. The variability in valve outline as observed by us on the type slide was also depicted by CHOLNOKY (1955) showing valves with a rhombic–lanceolate to linear–lanceolate outline. However, contrary to what Cholnoky claimed in his description (*Ihre Punktierung ist bei A. engelbrechtii nur im Phasenkontrast deutlich erkennbar*) it was not possible to resolve the areolae of the striae and to confirm the number of puncta (36 in 10 µm) observed by CHOLNOKY (1955). We suspect that the puncta, observed by Cholnoky in phase contrast only, are actually artefacts due to a bad adjustment of the phase contrast system. A similar conclusion was already reached by KRAMMER & LANGE–BERTALOT (1991, p.73).

Our observations confirm also those of SCHOEMAN & ASHTON (1983) (Figs 52–53) concerning the structure of the striae showing clearly that this species belongs to the genus *Planothidium* as already indicated by ROUND & BUKHTIYAROVA (1996) who validly published the new combination *Planothidium engelbrechtii* (CHOLNOKY) ROUND & BUKHT. The striae made of 3–4 rows of pori and the somewhat protracted poles (in the largest specimens) distinguish this species from its neighbours *Planothidium conspicuum* (A. MAYER) ABOAL, *Pl. renei* (LANGE–BERT. et R. SCHMIDT) VAN DE VIJVER and *"Achnanthes pinnata"* HUST., three species presenting striae made of only two rows of areolae and regularly oval valves rounded at the poles. In the past, several other African diatoms have been connected to *Pl. engelbrechtii*. Specimens from Senegal (COMPÈRE 1991: 206,



Figs 1–53. *Planothidium engelbrechtii* (Cholnoky) Round et Bukht. LM views of the type population: (1–27) rapheless valve views showing the range of variation of the type population; (28-43) raphe valve views showing the range of variation of the type population; (44–51) original drawings from Cholnoky (1955); (52–53) scan of the original TEM figures by Schoeman & Ashton (1983). Scale bar represents 10 µm.

fig.132) resemble quite well the typical *Pl. engelbrechtii*, with striae externally composed of several rows of areolae, but differ by the somewhat wider axial area, which is more enlarged near the central area. On the other hand, specimens from Guinea (Compère & Riaux–Gobin 2009) first linked to *Pl. engelbrechtii* clearly differ by their striae regularly composed of only two rows of areolae and thus resemble more *Planothidium renei, Pl. conspicuum, Pl. pericavum* (J.R.Carter) Lange–Bertalot or "*Achnanthes pinnata"*. *Planothidium renei* was originally described from the Antarctic King George Island in the southern Atlantic Ocean and later found on several sub–Antarctic islands of the southern Indian Ocean (Van de Vijver et al. 2001, 2002, 2004, 2008). Le Cohu & Maillard (1983) identified their specimens from Kerguelen, one of the sub–Antarctic islands in the southern Indian Ocean as *Pl. engelbrechtii*. In a more recent publication, Le Cohu (2005) changes this identification to *Pl. renei*. *Planothidium renei* not only possesses 2 rows of areolae instead of 3–4 in *Pl. engelbrechtii* but has different terminal raphe fissures, deflected to opposite directions whereas in *Pl. engelbrechtii* the terminal fissures are deflected to the same direction. Lange–Bertalot et al. (2003) found *Pl. engelbrechtii* in several ephemeral freshwaters on Sardina and Corsica. Their suggestion that *Pl. engelbrechtii* and *Pl. pericavum* might be considered being synonyms, should be rejected. *Pl. pericavum*, originally decribed from Tristan da Cunha (Atlantic Ocean) by Carter (1966) has less protracted valve apices and striae composed of only two rows of areolae. Whether the valves shown in Krammer & Lange–Bertalot (1991, plate 39 figs 24–33)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belong to *Planothidium engelbrechtii* is doubtful considering their different, more rhombic valve outline and their lower number of striae in 10 µm (13 vs 16–18 in the type population).

Using the morphological results of the present study, it is clear that all *Pl. engelbrechtii* populations need to be revised in order to determine the exact geographical distribution and the correct ecological preferences of this species.

Formal lectotypification

Cholnoky (1955) cited several samples from the Jakkalsrivier and the Olifantsrivier (South Africa) from which he described his new species *A. engelbrechtii*. Among these samples, the highest abundance (15.8%) of *A. engelbrechtii* was said to be reached in the sample Jakkals 3. Since the specimens of *A. engelbrechtii* in this sample are rather abundant and agree with the original description of Cholnoky, we designate formally as lectotype for this species the slide CSIR 326/6504, made from the sample JO3, July 1953, collected by A. Engelbrecht. The slide CSIR 326/6503, from the same sample will be an isolectotype.

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Figs 54–59. *Planothidium engelbrechtii* (Cholnoky) Round & Bukht. SEM external views of the type population: (54) external SEM view of an entire raphe valve showing the raphe structure and the overall habitus of the species; (55) external SEM view of an entire rapheless valve showing the overall habitus of the species; (56) external SEM detail of the central area of a raphe valve with the typical structure of the central striae and the central raphe endings; (57) external SEM detail of a rapheless valve with the typical raised ribs between the striae and the 4 rows of areolae of each stria; (58) external SEM detail of the valve apex of a raphe valve. Note the typical terminal raphe fissure and the merged terminal striae; (59) external SEM detail of the striae of the rapheless valve with 3 rows of areolae. Scale bar represents 1 µm.

Figs 60–61. *Planothidium engelbrechtii* (Cholnoky) Round & Bukht. SEM internal views of the type population: (60) internal SEM view of an entire raphe valve showing the raphe structure and the overall habitus of the species; (61) internal SEM view of an entire rapheless valve showing the overall habitus of the species. Scale bar represents 2 µm.

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