

both have large fibulae relative to the size of the transapical costae (but not as large, and not of the same shape, as those in N. vitrea) and possess central raphe endings.

Certain taxa seem to belong in other sections or genera. Thus, N. limes (Pantocsek 1902) is very similar to N. angustata, while N. fluminensis and N. majuscula, with their almost central raphes, resemble species of Bacillaria (see Peragallo & Peragallo 1897-1908, Pl.71-2). N. vacillata seems to belong in Hantzschia (see Giffen 1966, T.62 f.98-99).

The sect. Lineares, then, is in a chaotic state, and greatly in need of revision.

4.6.6.14 The section Lanceolatae

'Kiel stark exzentrisch. Schalen in der Regel lanzettlich mit mehr oder weniger deutlichen Transapikalstreifen.' (Hustedt 1930).

The sect. Lanceolatae was erected by Grunow (1880, and in Cleve & Grunow 1880) to include various small Nitzschiae which he had formerly placed in the Lineares (see Grunow 1862). Even in 1880 this section included nearly twice as many species as did each of the next largest sections, Tryblionella and Pseudotryblionella, and since this time the growth of the Lanceolatae has far outstripped that of any other group. Many new taxa have been described, especially by Hustedt (over 90 species) and Cholnoky (about 40 species), so that the section now contains over 300 described 'species'. It is not surprising that Fren-guelli (1943) wanted to change the name of this group to 'Eunitzschia' (i.e. 'true Nitzschia').

Since 1880 no one has suggested any changes in the circumscription of this vast section: indeed, only recently (Lange-Bertalot 1977) has there been any attempt at taxonomic revision. Diatoms belonging to the sect. Lanceolatae are widespread in all types of freshwater and

marine habitats, and can be very abundant: the elucidation of their taxonomy is therefore a matter of some importance and urgency, but the number of taxa to be considered makes this task daunting.

Several workers have used electron microscopy to study species of this section. Helmcke & Krieger (1953-) have illustrated N. amphibia (T.85-87, 398-9), N. communis (T.913-4), N. frustulum vars. perminuta (T.194) and perpusilla (Pl.511), N. heufleriana (T.84), N. palea (T.90) and N. valdestriata (T.195). Hasle (1964) studied five marine species (N. braarudii, N. bicapitata, N. norvegica, N. sicula and N. americana), while Schoeman & Archibald (1976-) have published information on N. communis, N. elegantula and N. siliqua. Lange-Bertalot (1977), using light and electron microscopy, examined nearly 40 'species' and, as a result of his studies, came to the conclusion that only 26 of these were worthy of specific rank. In several cases, however, Lange-Bertalot's conclusions are unsupported assertions, not backed up by micrographs, nor by any other proofs (e.g. statistical analyses of fibula spacings, etc.). Thus, for instance, his claims that N. admissa and N. holsatica are later synonyms of N. paleacea are quite likely true, but proof of this is not supplied. In the case of N. admissa light micrographs are provided (T.1 f.8-12, 16) which do indeed show a resemblance between this taxon and N. paleacea, and we are assured that 'eine vergleichende elektronenoptische Analyse', the results of which are not supplied, shows that these taxa are identical, while concerning N. holsatica no illustrations or analyses are provided. Lange-Bertalot asserts confidently, however, that the formation of stellate colonies by N. holsatica (see section 4.4) is 'kaum systematisches Artmerkmal, sondern eine Wuchsform unter optimalen Bedingungen, die nicht auf N. paleacea beschränkt ist.' Such unsupported statements might, perhaps, be acceptable were this work not claimed to be a systematic revision of the sect. Lanceolatae, which group, on Lange-Bertalot's admission, is one

of the most problematic groups within the Bacillariophyta, and which according to Lange-Bertalot (p.284) 'can no longer be differentiated without the aid of submicroscopical characters.' Lange-Bertalot also states that N. congolensis Hust. and N. woltereckii Hust. and various other taxa are all variants of N. intermedia: clearly Hustedt, whose experience of the diatoms was vast, did not think so, and therefore it is necessary for Lange-Bertalot to prove his assertions by careful and very extensive analysis of the variation pattern. Otherwise we are left with a choice between believing Lange-Bertalot and believing Hustedt, with no evidence to guide our decision.

In this group of diatoms, where the differences between described taxa are often slight or of dubious significance, it will be necessary to make detailed studies of diatoms from an enormous number and variety of samples before useful taxonomic revision can be attempted. As well as the traditional studies of morphology using light and electron microscopy, it will probably be necessary to perform statistical analyses of such matters as fibula spacing, stria density, poroid size, etc., such as those attempted in Hantzschia (see section 4.5.7.2), but refined and adapted for use in the Lanceolatae. Numerical taxonomic techniques could then be used to sort the data and distinguish phenetic groupings. These must then be related to the groupings previously recognised and named by taxonomists: in this connection Lange-Bertalot has made a very valuable start through his reinvestigations of type material.

The information necessary for it to be possible to identify Nitzschia species belonging to the sect. Lanceolatae is scattered through many scientific articles, some of them published in little known journals (e.g. four species published by Skvortzow 1975 in the Quarterly Journal of the Taiwan Museum). Moreover, in this section it is quite essential that the illustrations of taxa are accurate and easily

Nitzschia sect. Lanceolatae - species studied.

Species:	Source:*
<u>N. acidoclinata</u> (LM)	B.M. slide 18179
<u>N. amphibia</u> (LM, TEM, SEM)	8, 45
<u>N. bicapitata</u> (LM, SEM)	plankton sample 'F.65.26' (see sect. <u>Pseudonitzschia</u>)
<u>N. communis</u> (LM, TEM, SEM)	28, 78, 36, etc.
<u>N. ?diserta</u> (LM)	78
<u>N. fonticola</u> (LM, SEM)	80
<u>N. frustulum</u> (LM, SEM)	58(Cumberland Basin area)
<u>N. hantzschiana</u> (LM, TEM, SEM)	8, B.M. slide 23367
<u>N. cf.hantzschiana</u> (LM, SEM)	8
<u>N. ?inconspicua</u> (LM)	80
<u>N. ?minuta</u> (LM)	9
<u>N. palea</u> (LM, SEM)	12, 28, 62(Brockweir: enrichment culture),90
<u>N. paleacea</u> (LM, TEM)	80
<u>N. pusilla</u> (LM)	9, 12, 78, 80
<u>N. romana</u> (LM)	80
<u>N. ?steynii</u> (LM)	80

and various others, which it has not been possible to identify, from the same samples.

*The numbers refer to samples listed in Appendix 1.

interpretable, but this is a requisite which is not often satisfied. Hustedt (1930) described, illustrated, and provided a key for the identification of 17 species, but as Lange-Bertalot (1977) has shown, his treatment is sometimes inaccurate. The same criticism may be made of Cleve-Euler's (1952) work, while the key provided by Archibald (1972a, b) has not, in my experience, proved of much use, probably because of its artificiality and because it is difficult to interpret such words or terms as 'protracted', 'linear-lanceolate', etc.; certainly, on several occasions when I have used this key the diatom indicated by the key has not resembled the specimen in question. A forthcoming work by Simonsen & Lange-Bertalot (Simonsen, pers. comm.) may clarify the situation considerably.

So few species of the Lanceolatae (relative to the total number in the group) have been examined during the present study that it is not possible to reach any conclusions about the section's taxonomy. Discussion will therefore be limited mainly to a consideration of the usefulness of various characters. The species examined, together with their sources, are listed in Table 23.

The first character which may be considered is the symmetry of the frustule about the median valvar plane. Originally it was thought that all Nitzschia cells were diagonally symmetrical about this plane, whereas Hantzschia cells were 'spiegelsymmetrisch' (Text F.2B, E). Lauritis et al. (1967) showed, however, that in N. alba both types of symmetry are exhibited: these observations were extended by Geitler (1968c), who noted that nitzschioid and hantzschoid cells occur in a 1 : 1 ratio in natural populations of N. sigmoidea, N. flexoides, N. palea, N. subtilis and N. kützingiana. The last three of these species belong to the sect. Lanceolatae, and thus, since Geitler (op. cit.) found also that N. fonticola, another member of the Lanceolatae, exists only in the nitzschioid form, it appears that symmetry may be a useful character in this section. It should be noted, however, that in the

present study no hantzschoid examples have been observed among thousands of frustules of sect. Lanceolatae species (including N. palea) examined. This suggests that N. palea, N. subtilis and N. kützingiana are anomalous, that hantzschoid frustules are more likely to fall apart during acid cleaning, or perhaps that Geitler's observations or identifications are incorrect. It would seem in any case that at least N. hantzschiana, N. cf. hantzschiana (see later), N. communis and N. pusilla are always nitzschoid, like N. fonticola.

The frustule is always quite narrow in girdle view, and more or less parallel-sided (F.907, 924): at the centre it may be very slightly constricted if central raphe endings are present (unpubl. obs. of N. hantzschiana).

Valve shape and size have traditionally been important characters in this section (F.367-489). However, the changes of shape accompanying size reduction during vegetative division must be carefully monitored and noted before taxonomic conclusions are drawn. The changes in shape follow the 'rules' laid down by Geitler (1932; see section 4.3) and can be very pronounced - a linear valved diatom with ± capitate ends may give rise eventually to cells with virtually elliptical valves. Two series of valves which demonstrate such changes are depicted in F.384-9 and 390-5. It will be noted that in the longest cells (F.389 and 391) the valve poles are somewhat protracted, almost capitate in F.391, whereas in the smallest (F.384 and 395) this feature has almost completely disappeared. Providing that allowance is made for these changes, however, there is no reason why valve shape should not be used as a taxonomic character.

Isolated measurements of length are of little value since there is no means of knowing which stage in the reduction cycle they represent, but the range of length exhibited during the life cycle is most useful, since it has been found (Geitler 1932; see section 4.3)

that the sizes of the auxospore mother cells and initial cells are constant within narrow limits. Isolated measurements of width are of more value, since this parameter alters little during vegetative division (compare the valves within each of the three series depicted in F.379-83, 384-9, 390-5). Valve depth is much more difficult to measure than either of the foregoing, but should prove useful taxonomically.

As in other pennate diatoms, stria density has always been an important character. The density is apparently constant within a clone (see Geitler 1932), but a 'species' may show a range of densities. Thus, if Lange-Bertalot's interpretation of N. intermedia is correct, then this taxon includes a range of forms, from those with stria densities as low as 21 in 10 μm . to those with 33 in 10 μm . Nevertheless, this character is certainly useful.

The valve construction is of type 1 (F.905-6, 913, 918, 921-3, 925-926, 930-1, 933-4, 935-6, 937-8, 945-6, 948, 950, 952, 954), except in a few species which should probably be transferred out of the section. One of these, N. valdestriata, possesses two rows of poroids between adjacent transapical costae (Helmcke & Krieger 1953- , T.195), while N. delognei has a valve and raphe structure which sets it apart from all other species of Nitzschia (Simonsen, pers. comm.): its closest relative may be Cymatonitzschia marina.

It is clear that 'valve construction' may be broken down into a number of characters. First, there is the relative development and placing of costae and frets. Here it is instructive to compare N. communis, where costae and frets are of almost equal thickness (F.937-41), with N. amphibia, where the costae are much deeper than the frets (F.905-6, 909-10). The diameter of the poroids is also useful: this must be measured relative to the distance between adjacent transapical costae if meaningful comparisons are to be made, since clearly the poroid diameter cannot be greater than this distance. Thus, although

the poroids of N. communis and N. hantzschiana (both from a sample collected from the walls of Carreg Cennen Castle, Dyfed) are of almost the same size in absolute terms (0.1 μ m. diameter)(F.557, 559-60), those of N. communis are much larger if measurement is made relative to the intercostal distance. By extension, moreover, it would seem appropriate that the transapical distance between the poroids should also be measured relative to the intercostal distance.

The shape of the poroids may be useful, even though considerable variation may occur within a single valve. Within a valve of N. hantzschiana, for example, the poroids are variously circular or \pm elongated transapically: on the whole, however, they are more elongated transapically than those of N. communis (F.557, 559-60).

The poroids are apparently always closed by hymena (Lange-Bertalot 1977, my observations, etc.) in which the pores are arranged randomly/subregularly (F.559-60, 562) or in hexagonal array (F.557-8, 561, 564). In addition there may be other occluding structures present, such as the 'cribra' in N. amphibia (F.908, 557), which closely resemble the structures found in the poroids of N. sinuata (sect. Grunowia). There may also be variation in the position of the occlusion within the poroid: in N. frustulum (F.923) and in the diatom illustrated in F.428-430, 943-7, the hymen seems to be placed nearer the outer surface of the valve than in, for example, N. amphibia (F.908, 910).

Within the subaphe canal the striae become double in several taxa, which include N. amphibia (F.905, 907-9), N. hantzschiana (F.912-915, 919-20), N. cf. hantzschiana (F.928-9), N. fonticola (unpubl. obs.), and, according to Lange-Bertalot (1977), N. acidoclinata and N. romana. In these species the poroids within the subaphe canal differ from those on the valve face only in size (F.557), and sometimes also in that their external apertures are surrounded by rims of silica (e.g. in N. cf. hantzschiana: F.929). The numbers of apical rows of such canal

poroids varies within the above group, from one row in N. amphibia to two rows in N. hantzschiana, N. cf. hantzschiana and N. fonticola (unpubl. obs., illustrations cited above, and Lange-Bertalot 1977): the doubling of the striae takes place on both sides of the raphe (e.g. F.809). In those taxa in which doubling does not occur there is usually one row of poroids on each side of the raphe, within the subraphe canal (e.g. F.936).

At the junction of the valve face and distal mantle there may be a marginal ridge. Thus, Geitler (1968c), by careful light microscopical examination of a thick preparation of ?N. subtilis, found that ' .. an den kielfreien Kanten der Schalen je eine über die ganze Länge der Zelle laufende Flügelleiste von der gleichen Höhe wie der Kiel vorhanden war.' In addition, the present study has revealed that two species, N. communis and N. cf. hantzschiana (but not N. hantzschiana), have well-developed marginal ridges (F.938-40; 924-5, 928-9), while N. bicapitata seems to have a similar, but smaller structure (F.922).

Another character is the degree of development of the distal mantle: in N. cf. hantzschiana there is a fairly extensive mantle (F.924, 927), as in N. angustata (sect. Tryblionella), while in many other taxa a distal mantle can hardly be distinguished (F.923).

The raphe system is always strongly eccentric (F.367-489). Indeed, for a species to be included in the sect. Lanceolatae it must be possessed of this character: Grunow's diagnosis of the group (in Cleve & Grunow 1830), which has been left ± unaltered by subsequent authors (compare Hustedt's description, quoted above), states 'Schaalen lanzettlich, linear lanzettlich oder seltener oval, mit sehr excentrischem Kiele, ungefaltet, Kielpunkte nicht verlängert.' Nevertheless, we must be prepared to accept into the Lanceolatae forms whose raphe systems are not strongly eccentric, should these forms be deemed, on other grounds, to be closely related to 'more typical' members of the group.

At present, however, I am unaware of the existence of any such forms and thus, within this section, the position of the raphe system does not seem to be taxonomically useful (contrast the 'Obtusae' group; see sect. Nitzschia).

Internally, at each pole the raphe fissure ends in a simple helictoglossa (e.g. F.937, 944, 951): this is usually detectable using the LM (e.g. F.367, 376, 379, etc.). The terminal fissure is fairly short, and curves off towards either the proximal (F.905, 923, 932, 936, 946) or distal margin (F.920): in N. hantzschiana (F.913, 917), N. cf. hantzschiana (F.927-8) and N. communis (F.938-9) it has been demonstrated that the fissure may curve in either direction within the same species, but that within a single valve both fissures are turned towards the same side (unpubl. obs.). The only variation in the morphology of the polar raphe endings which would seem to be of use taxonomically is in those members of the section which are marine and planktonic, where a terminal fissure is absent (see Hasle 1964).

Central raphe endings may be present or absent: great stress has been placed on this character by the 'South African School' (Cholnoky, Archibald, etc.), and by Simonsen & Lange-Bertalot (forthcoming paper; Simonsen, pers. comm.). When present, the central endings are coaxial-symmetrical both internally and externally, and are quite unremarkable (F.909, 915, 919, 954, unpubl. obs.). The presence of central endings is often (F. 367-70, 379-83, 396-7, 400-4, etc.), but not always (F.371, 391, 398-9, 409, 431) accompanied by a wider separation of the median pair of fibulae; the endings themselves can usually (?always) be detected by the careful use of the LM, as a 'central nodule' (F.367-71, 379-83, 390-5, etc.). It is difficult to imagine that this character might vary within a species, but there is no a priore reason why not, and a particular emphasis on this one character is unwise.

The raphe is sometimes bordered by ridges like those in N. mollis

var. africana or N. linearis (sects. Panduriformes and Lineares respectively). In N. cf. hantzschiana these ridges are especially well marked (F.928-9), while in N. hantzschiana (F.912-20) they are less obvious, and in N. frustulum (F.923) and N. palea (F.952) they are absent.

Two types of fibulae have been distinguished. In the first, exemplified in N. amphibia, each fibula represents one or more fused subraphe costae (F.367-71, 906, 910). Usually the fibula represents one or two costae, but occasionally larger aggregates are to be found (F.371). The fibulae are quite distinct, one from another, although longitudinal ridges do run between the fibulae, at the entrance into the subraphe canal (F.910). In the other type, which, judging by the data available so far, seems to be that present in the majority of the Lanceolatae, the fibulae are of various sizes, often appearing to represent single or fused subraphe costae, but always failing to be totally convincing in this regard (F.914, 916, 921, 926, 933-5, 937, 941, 945, 948, 950, 954). Here there are fairly prominent longitudinal ridges proximally and distally, from which the fibulae spring: the latter do not extend beyond these ridges onto the valve. It may be that intermediates between these types will be found. Certainly, in some examples of N. cf. hantzschiana the fibulae do appear to be genuinely equivalent each to several fused subraphe costae, but elsewhere in this taxon no relationship between these elements can be detected (unpubl. obs.).

The linear density of the fibulae may be used as a character, but it should be stressed that the density may be very variable even within a single clone or population. Thus, for instance, the frustule illustrated in F.465 has 12/13 fibulae in 10 μm . on one valve, but 15/16 on the other: a similar discrepancy is present between the valves of the frustule illustrated in F.469. In order to investigate interpopulational differences with regard to this character, it will be necessary

to analyse large numbers of valves, and to determine mean density values, with some measure of the scatter. Fibula density should be calculated relative to the stria density, in order to allow for any spatial relationship there may be between fibulae and costae, such as is definitely present in N. amphibia.

There is always a distinct subaphe canal, which is usually set above the general level of the valve (e.g. F.913, 920, 928). The degree of elevation, and the size of the canal, are variable and could be used as characters, though both are somewhat difficult to measure.

The taxonomic usefulness of the cincture has yet to be evaluated. The members of the sect. Lanceolatae are, in general, so small that the SEM must be used at the limits of its resolution before much useful information can be gained about the cincture structure. N. amphibia, N. hantzschiana and N. cf. hantzschiana (F.927) all appear to have at least three open bands in the mature cingulum; the first band is considerably wider than the others, and bears a single transverse row of poroids (F.907, 909, 912, 927). The first band of N. amphibia is ornamented with numerous small warts (compare N. sinuata, sect. Grunowia; N. angustata, sect. Tryblionella).

The cytology of the Lanceolatae has also provided little of use so far (F.490-505), although the size of the Bütschli globules may prove significant (compare F.490-1 with 495-7). There are always two chromatophores per cell, arranged as in the majority of Nitzschia species. Each contains a single, elongated pyrenoid, usually in that part of the chromatophore lying against the girdle: it therefore appears as a less heavily pigmented, thickened part of the plastid, seen most easily in valve view (F.491, 495, 497, 499).

There is one other feature, which deserves separate mention because of its rarity within Nitzschia, or even within the Nitzschia-iceae. This is the occurrence of poroids around the pole, between the

helictoglossa and the valve margin, found in N. palea (F.951) and N. sociabilis (Lange-Bertalot 1977, T.10 f.3). In all other species of Nitzschia, Bacillaria, Hantzschia, etc. which have been studied, except N. sublinearis (F.891), the helictoglossa lies at the inner edge of the marginal strip, with no poroids between it and the margin itself. Perhaps it is no coincidence that the section of Nitzschia in which this feature is found is also the section containing species which form stellate colonies (see section 4.4), although the apical pores of these Nitzschiae do not resemble the pore fields in Asterionella, Gomphonema (unpubl. obs., Dawson 1972, etc.), etc. Many Navicula, Pinnularia, Caloneis and Anomoeoneis species have areolae beyond the helictoglossa as in N. palea or N. sociabilis (unpubl. obs.).

By the use of the characters discussed above (and others) it should be possible to clarify the taxonomy of the sect. Lanceolatae. Several of the characters mentioned cannot be seen, or cannot be assessed accurately, using light microscopy, and so the classification of the Lanceolatae cannot be advanced appreciably without the extensive and intensive use of the electron microscope. On the other hand, is it true that the identification of species must also be dependent upon the use of 'submicroscopical characteristics' (see Lange-Bertalot 1977, p.284)? It may be that some species will be found which do require EM examination for their identification, but in most cases I believe that careful use of the light microscope will prove adequate: an example, where two very similar, but distinct taxa were found in the same sample, may serve to illustrate this.

A subaerial 'streak' of diatoms on the underside of the bridge over the Afon Bran at Llandovery, Dyfed, was sampled and proved to contain various species (amongst which the commonest were a small Amphora species fairly similar to A. ovalis var. pediculus, Navicula contenta, N. pusilla, Diploneis ovalis, Pinnularia borealis, Caloneis

bacillum, Achnanthes coarctata, A.?minutissima, Fragilaria sp., Nitzschia debilis, N. linearis, N. sinuata, N. solgensis, and an unidentified Nitzschia sp. illustrated in F.372-5), including some diatoms which were at first all identified as N. hantzschiana, using the key provided by Hustedt (1930). SEM examination of these 'N. hantzschiana' frustules showed, however, that they fall into two distinct groups (F.379-83, 918-21 and 384-9, 924-9 respectively) according to whether central raphe endings and marginal ridges are present/absent and absent/present, although in other respects their structure is similar.

In the light microscope these cells look very alike: both have approximately the same dimensions, and have 24-26 striae and 7-11 fibulae in 10 μm . Nevertheless, they are distinguishable, since there is a distinct 'central nodule' (which represents the central raphe endings) in the valves of the first group, while careful study reveals also that these valves are slightly narrower (2.7-3.2 μm . as against 3.5-4.0 μm .), and less robust in appearance: they also have slightly fewer striae and more fibulae per unit length, although the ranges overlap. It is this first group which is to be identified with N. hantzschiana, according to Lange-Bertalot (1977). The second group, which has been called 'N. cf. hantzschiana' in this thesis, has apparently never been recognised taxonomically, although it is difficult to be confident in this matter in view of the vast array of species which have been described as belonging to this section. The fact that both diatoms were quite abundant in the same sample suggests that their ecological preferences may not be very different, and so samples containing 'N. hantzschiana-type' cells must be examined especially carefully.

One further complication is that W. Smith's 'N. minutissima' seems to be merely a slightly more finely striate form of N. hantzschiana (compare F.390-5 with 379-83): if these two prove to be conspecific,

Smith's name, though unknown today, must take precedence since it dates from 1853, while N. hantzschiana was published in 1860 (teste Lange-Bertalot 1977).

From the evidence available so far, it seems that within the sect. Lanceolatae there are some taxa which exhibit much variation, while others are relatively constant in their morphology. As an example of the latter may be mentioned N. communis, now that N. pusilla has been distinguished from it (Lange-Bertalot 1977). N. communis is easily recognisable by its shape, lack of central raphe endings, and the linear densities of fibulae and striae (9-12 and 30-34 in 10 μm . respectively - see F.434-41): observations of this species on specimens drawn from a variety of localities indicate that the valve structure hardly varies. At the other extreme is N. intermedia, in which Lange-Bertalot includes a vast range of forms, some previously recognised as separate species.

In one sample there may be forms, all with a \pm identical frustule structure, stria/fibula densities, etc., but with a variety of valve outlines, this variety not being attributable to shape changes caused during size reduction (see F.411-20, 930-6; 471-7).

The patterns of variation present in the Lanceolatae are somewhat bewildering, but their analysis is the only means by which the taxonomy of this section can be clarified. While our knowledge of the reproductive biology of these (or any other) diatoms remains at its present level, however, our understanding of what determines this pattern will not grow, and a full integration of taxonomy with other aspects of 'diatomology' will be prevented.

The sect. Lanceolatae, because of its size, the complexity of its variation pattern, and the frequency of occurrence and ubiquitousness of many of its members, shows up more than does any other group of diatoms our ignorance of diatom biology.

A few other points may be made.

Several matters suggest that N. amphibia is probably quite closely related to the sect. Grunowia. Thus, of all the Lanceolatae, N. amphibia is one of the most coarsely structured (cf. sect. Grunowia) with only 15-16 striae in 10 μm . (F.367-71). The poroids are large, and conspicuous even in the light microscope, and each contain a 'cribrum' in addition to the hymen: this cribrum is very similar to that found in N. sinuata. Moreover, the fibulae bear an exact spatial relationship to the transapical costae in both taxa, and the structure of the cincture also appears fairly similar (note the presence of warts on the bands of both N. amphibia and N. sinuata). On the other hand, it should be noted that N. amphibia differs from the Grunowiae in that central raphe endings are present, the striae become double within the subraphe canal, and the fibula morphology is much simpler.

N. amphibia is also similar to N. angustata (sect. Tryblionella). Valve, raphe and subraphe structure are very alike in these taxa, although a well-developed marginal ridge is present in N. angustata, but lacking in the other. Geitler has observed auxospore formation in both (see section 4.3) and found them to differ, but N. angustata's method of formation is like that of another member of the Lanceolatae, namely N. fonticola, and thus it is probable on several grounds that the relationship between N. angustata and the sect. Lanceolatae is very close.

4.6.6.15 The section Nitzschiella

As with various other sections of Nitzschia (e.g. Tryblionella, Grunowia and Perrya), this section was originally a separate genus, declared as such in 1864, by Rabenhorst. Subsequently Grunow (in Cleve & Grunow 1880) reduced it to the status of a subgroup of Nitzschia, and most authors have followed his example. Grunow had previously (1862)