

**HAGEN'S TUBERCLE, A LARGELY OVERLOOKED
BUT POTENTIALLY USEFUL CHARACTER
IN GOMPHID TAXONOMY
(ANISOPTERA : GOMPHIDAE)**

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HAGEN's interesting comments on the shape of the ventral surface of the first abdominal segment in the males of the "Légion *Lindenia*", contributed to SÉLYS's "Monographie des Gomphines", have been overlooked by most later workers. *Diastatomma tricolor* (Palisot de Beauvois), in which the "tubercle" on this segment is spectacularly developed, was only known in HAGEN's time from a single specimen in which half this segment was missing, so the tubercle is not mentioned. More material is now available for study, and the genera *Diastatomma*, *Gomphidictinus* and *Gomphidia* are discussed in the light of this.

The matter of this paper starts some ten or fifteen years ago, when I was trying to identify some West African gomphids and comparing them with those in the British Museum and other collections. I found several specimens in these that had been incorrectly identified, species unknown at the time and confused with better known forms, mostly with those from Zaire.

Two of these can be dismissed in a few words. A "West African" specimen of *Ictinogomphus fraseri* Kimmins, 1958 had been misidentified as *I. regis-alberti*, known from Zaire and N. Angola. And a *Gomphidia madi* Pinhey, 1961 from Dahomey had been mistaken for *G. quarrei*, also a Zaire species. Both these specimens have been referred to by FRASER and by Miss LONGFIELD, and have been accepted by PINHEY and quoted in his Descriptive Catalogue (1962). This demonstrates the dangers of such misidentified specimens being left in Museum Collections uncorrected, and the confusion that can be caused to future students of the distribution of species.

The two other misidentifications concern species which are still undescribed, and I shall be dealing with these in a separate paper. One of these was a further *Gomphidia*, from Nigeria, in the late Eric GARDNER's collection, since acquired by the B.M., labelled *G. balii* Fraser, and identified for him by FRASER himself, but quite different from his original *balii* material from Zaire. Two other Nigerian specimens have been found, and Dr Sally CORBET has found one in Cameroun. The other misidentification, from which the whole of today's study springs, was in the B.M. series of *Diastatomma soror* which contained a mixture of species, genuine *soror* from Zaire and a male and two females from Sierra Leone of something quite different, and unlike anything hitherto described. Dr LINDLEY has found another male of the new species in the Cote d'Ivoire, and Herr Jochen LEMPert has found a further one in Liberia.

This sent me back to reread the earlier literature of this group of Gomphids, which shed a new light on various matters I had not considered before.

DE SÉLYS-LONGCHAMPS in his *Monographie des Gomphines* (1858) quotes extensively from notes contributed by HAGEN, especially on the "Légion *Lindenia*", nowadays considered the subfamily Lindeniinae. These make considerable mention of the ventral surface of the first abdominal segment of the male.

p. 250 (re Légion *Lindenia*). "... PARTIES GÉNITALES. Males. Premier segment abdominal avec le bord apical en dessous plus ou moins développé en tubercule, parfois presque nul, différant selon les espèces ; ..."

p. 254 (re *Diastatomma tricolor*). "Le bord apical du 1^{er} segment en dessous manque ..."

p. 267 (re "*Ictinus*", now *Ictinogomphus* Cowley, 1934) ; group 1 *I. decoratus* etc. (Fig. 1, 2) i.e. *Indictinogomphus* Fraser, 1939). "... ♂ Pièce antérieure largement échancrée, mais non visible de côté, ne dépassant pas le bord ventral, presque tout-à-fait couverte par le tubercule du 1^{er} segment ; celui-ci pro-éminent, avec une ligne basale denticulée de chaque côté, et une impression médiane antérieure ; bord ventral longé en bourrelet, un peu plus détaché en arrière où il est denticulé ..."

p. 268 (re group 2, *I. clavatus* etc., i.e. *Sinictinogomphus* Fraser, 1939), (Fig. 3, 4) "... ♂ Tubercule plus court, ne couvrant pas la pièce antérieure qui est grande, fendue au bout avec un tubercule carré au milieu ; ..."

(Re group 3, *I. ferox*, type species of the genus, there is nothing in the notes relevant to the tubercle, — in fact there is no mention of the first segment at all, — which implies that the tubercle is absent, which is confirmed by examination of specimens of this common species).

p. 294 (re *Cacus*, now *Cacoides* and removed to the subfamily Gomphoidinae together with *Progomphus* etc, all of them New World genera). "... ♂ ... Bord final du 1^{er} segment droit, avec un tubercule presque nul. Pièce antérieure à demi cachée par lui, échancrée au bout ..."

p. 298 (re *Lindenia*) "... ; bord final du 1^{er} segment lisse en dessous, droit, sans tubercule. Pièce antérieure largement échancrée au bout, avec deux impressions basales non cachées par le 1^{er} segment ..." (I have no satisfactory drawings of these last two, so I figure instead *Gomphidia*, which is similar). (Fig. 5).

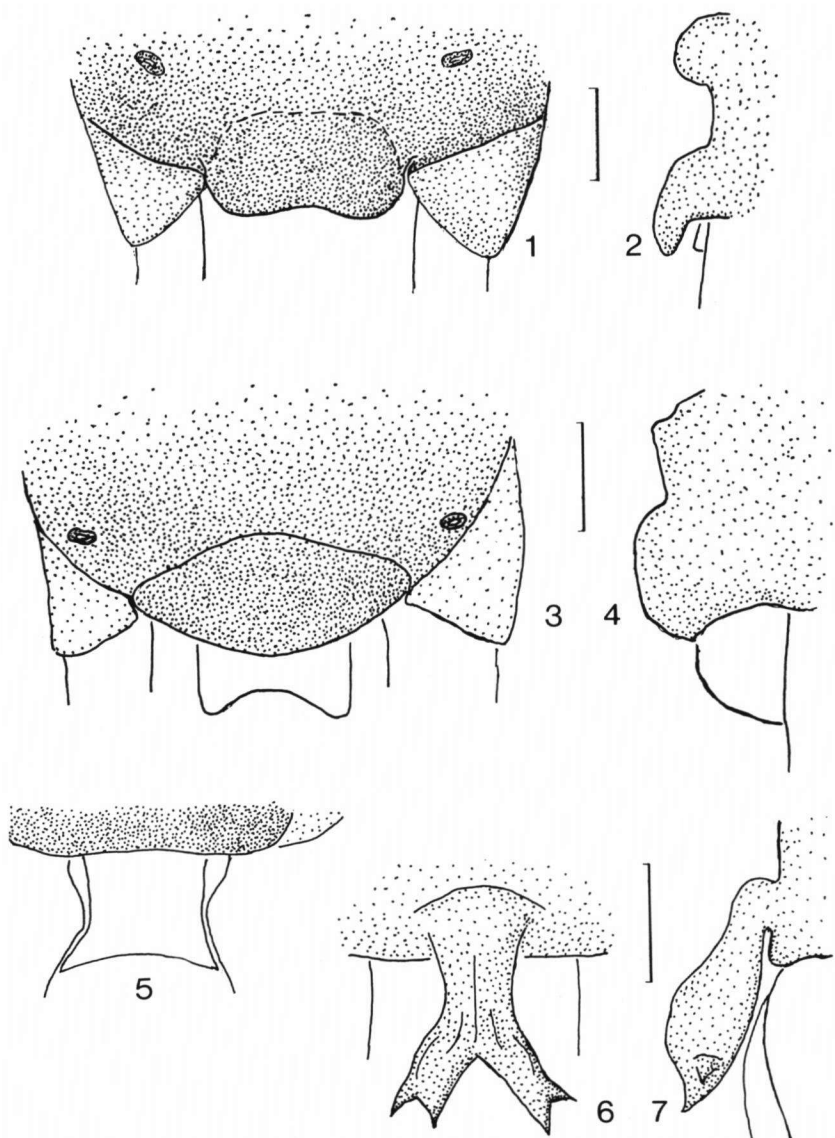


Fig. 1-7. 1st & 2nd abdominal segments (1st segments shaded) to show the tubercle: - (1) *Indictinogomphus decoratus*, ventral view; - (2) *I. rapax* in lateral view, as this species - unlike *decoratus* - shows the extent of the anterior lamina when viewed laterally; - (3-4) *Sinictinogomphus*, ventrally (3) and laterally (4); - (5) *Gomphidia madi*, posterior margin of 1st segment, ventral view; - (6-7) *Diastatomma tricolor*, ventrally (6) and laterally (7). Scales = 1 mm.

It was most unfortunate that the only specimen of *Diastatomma* known in HAGEN's time lacked the hind margin of the first abdominal sternite. Further specimens have been found since, and show that *D. tricolor* has a particularly large and prominent tubercle, even for a *Diastatomma*, where this structure is larger and more conspicuous than in any other known Lindeniine genus (Fig. 6, 7). I feel sure that if HAGEN had been able to see a complete specimen, he would have had much more to say about its tubercle than the brief mention he makes in his notes on those species in which it occurs, and much more attention would have been paid to it by later workers.

Even as it is, I find it strange that this character has not been followed up to a greater extent. Doubtless it is well-known to Museum workers who are trying to identify specimens — especially *Diastatomma* — by comparing them with others, but I am only aware of very few references in the published literature, and none of these have associated it with the tubercle noted by HAGEN. The most important is in a paper by FRASER (1942) on a collection of dragonflies made in the Federated Malay States. For one of the new species described, he erected a new genus, *Gomphidictinus*. In his description he says «... anterior to the genitalia, and projecting from the first abdominal segment, is a unique quadrate lobe which overlaps the anterior lamina and hamules.» (Fig. 8).

Another to call attention to this — or any similar structure — is DUNKLE's recent paper in *Odonatologica*, where he mentions that many species of *Progomphus* have a small median finger-like spine with terminal denticles on the first abdominal sternite, in this case in both sexes, unlike the species already mentioned where it is in the male only. He expresses surprise that although the genus has twice been monographed recently, by BYERS (1939) and BELLE (1973), neither of them has mentioned this feature. Actually BELLE does refer to it very briefly, showing a map of the distribution of the nine species with a ventral process on 1, and on the next page he comments “all species with a slender mid-ventral process on abdominal segment 1 are found in the U.S., Central America, or the Greater Antilles” and gives their names. However the process here is a very minute structure, only 0.4 mm long, (Fig. 9-11), whereas in the African *Diastatomma* it can reach up to 2 mm. Note also that in *Progomphus* the process originates from the anterior ridge and not from the posterior, and well anterior to the spiracles. This, and the fact that both sexes have it, suggest that in this case the process is not homologous with HAGEN's Tubercle.

The genus *Diastatomma* has had rather a chequered history. It was described in BURMEISTER's Handbook of Entomology in 1839. It was originally a manuscript name used by CHARPENTIER, but BURMEISTER's was the first published definition of the genus. In those early days it comprised the whole of the known Gomphidae — plus *Cordulegaster* and *Petalura*! Its chief character was that although put into the Libellulidae (which then comprised the whole of the Anisoptera) on the strength of its general shape and its venation, the eyes did not meet dorsally over the head, thereby resembling the family then known as the Agrionidae and containing the whole of the Zygoptera. In fact the name *Diastatomma* signifies the standing apart of the eyes. BURMEISTER originally included nine species in the genus, but these have been removed one by one to other genera, until finally only one remained, *tricolor*, originally described in 1805¹ by PALISOT DE BEAUVOIS as *Aeshna tricolor*. (Incidentally, I always used to wonder why an insect patterned entirely in black and yellow should be named “*tricolor*”. But when I came to look up the original description, I saw that the work was published in Paris and the date was given as the year 13. So it dawned on me that 1805 was the Year 13 of the Glorious Revolution of 1793, and that the name of this splendid insect

¹ 1805 is the usual date given for the publication of PALISOT DE BEAUVOIS' “*Insectes rec. Afr. Amér.*” But GRIFFIN has shown that the work was published in parts, from 1805-1821. Bound volumes of the complete work do not usually include the title pages of the separate parts except for the first, so giving

must have been given in honour of the National Flag, rather than as a description of its colour-pattern.)

BEAUVOIS' "*Aeshna tricolor*", the only one of BURMEISTER's originally described species to remain in *Diastatomma*, thus becomes the type-species of the genus. But other species have gradually been added. SCHOUTEDEN (1934) described a number of *Diastatomma* in the more restricted sense from what was then the Belgian Congo, and divided them into two distinct groups. One contained *D. bicolor* Selys, 1869 and three new species, *aberrans*, *selysi*, and *soror*, with the cells below the pterostigma smaller and more numerous than those in the row immediately beneath them (Fig. 12, 13), and the superior appendages of the male forked, with the internal branch prominent and overlapping its opposite counterpart (Fig. 14-17); (*D. tricolor* was not mentioned as it is not a Congo species, but it would have come into this group). The other group contained three new species, *bredoi*, *quarrei*, and *sjoestedti*, where the cells below the pterostigma are larger (or at least longer) and fewer than those in the row below, and the appendages simple and straight. FRASER (1949) confirmed SCHOUTEDEN's findings, and added a third difference in the shape of the penis, whose tip was blunt and hooded in group 1, and ended in a pair of watchspring-like flagella in group 2 FRASER, 1949 (111, fig. 8). This structure was exactly like that of *Gomphidia*, previously considered an entirely Oriental genus, with which FRASER was familiar from his many years in India. He had already recognised the general resemblance even before he had started to examine the penes. In fact these African species actually were *Gomphidia*. In the same paper FRASER added a new species to each group. *Diastatomma multilineatum* and *Gomphidia balii*. We can now add yet a fourth distinction between the two genera, HAGEN's tubercle is present in *Diastatomma* and absent in *Gomphidia*.

Thus, as a result of the work of SCHOUTEDEN and FRASER, *Diastatomma* has become further split into two genera, *Diastatomma* and *Gomphidia*, the former confined to tropical Africa² and the latter extending across Africa and Asia. FRASER's new genus *Gomphidictinus* lies midway between the two, resembling *Diastatomma* in having HAGEN's tubercle prominent, and the sub-pterostigmal cells smaller and more numerous than those in the row below, and *Gomphidia* in having the superior appendages simple, and the penis with terminal flagella. Our late colleague, MAUS LIEFTINCK, pointed out in 1954 that FRASER's new species was actually the same as *Gomphidia perakensis*, described by LAIDLAW in 1902, and made the two species synonymous. Since when, *Gomphidictinus* has been regarded as a synonym of *Gomphidia*, and sunk accordingly. Actually, in view of HAGEN's tubercle, called by FRASER a "pregenital lobe", and the small and numerous cells below the pterostigma, *perakensis* should never have been put in *Gomphidia*. These characters are not present in *G. t-nigrum*, the type-species of the genus, or in any other *Gomphidia* that I have been able to examine. I wrote to MAUS about this, not wishing to disagree with such an expert, and asked whether it was his considered opinion that the actual genera *Gomphidia* and *Gomphidictinus* were synonymous, or was it

the impression that 1805 is the date of publication for the whole. Actually "*Aeshna tricolor*" and a few other dragonflies were described in Livraison 4, published in 1807. As no questions of priority of nomenclature are involved in this case, the matter is of no practical importance, and it would seem unnecessarily pedantic to correct the accepted date of 1805 to 1807.

² The only possible exception to this, is a specimen found in a box of unknown origin which recently came to light in the B.M.N.H. containing pinned Odonata — mostly European species. It also contained an unidentified male Gomphid with a printed label "N. INDIA", which was not only clearly a *Diastatomma*, but also extremely close to, and probably identical with the new species I have been referring to. However, it seems probable that this was a case of mistaken labelling, a supposition supported by the presence in the same box of an identically labelled unidentified female of the West African Corduliid species *Macromia insignis* (Kirby, 1889).

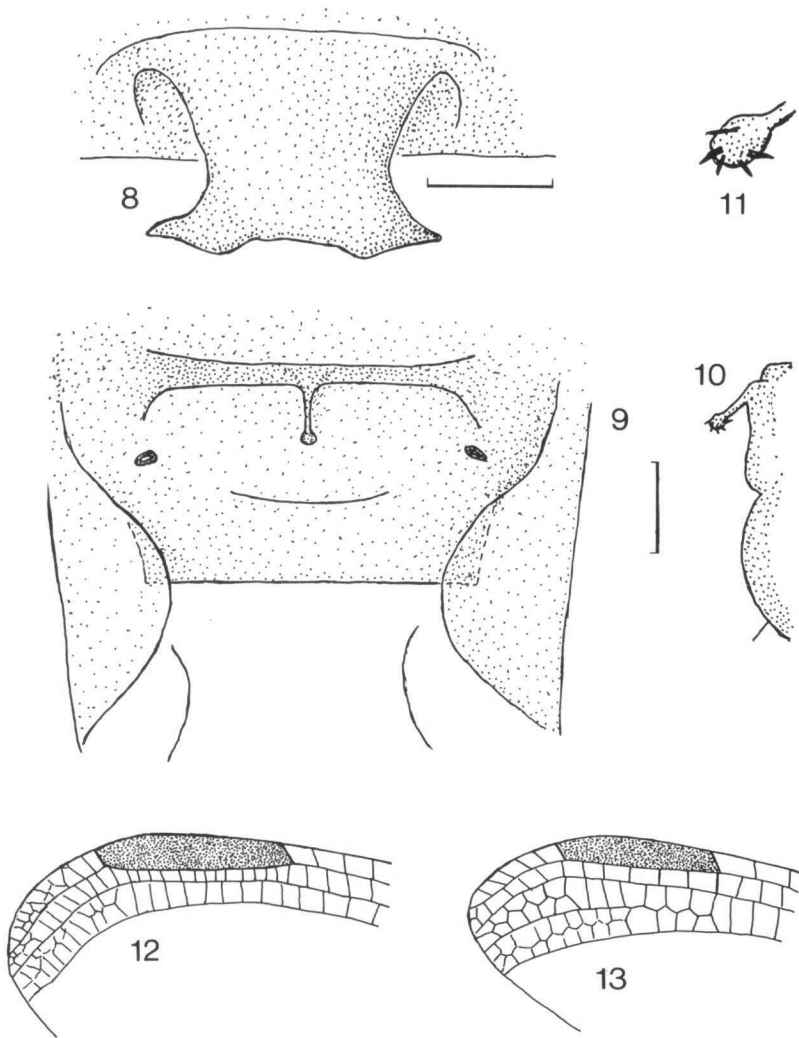


Fig. 8-11. Tubercle: - (8) *Gomphidictinus*, ventrally; - (9-11) tubercle (?) or ventral process of *Progomphus obscurus*, ventral (9) and lateral (10) views, the latter with tip further enlarged (11). Fig. 12-13. Subterostigmal cells: - (12) *Diastatomma tricolor*; - (13) *Gomphidia madi*. Scales = 1 mm.

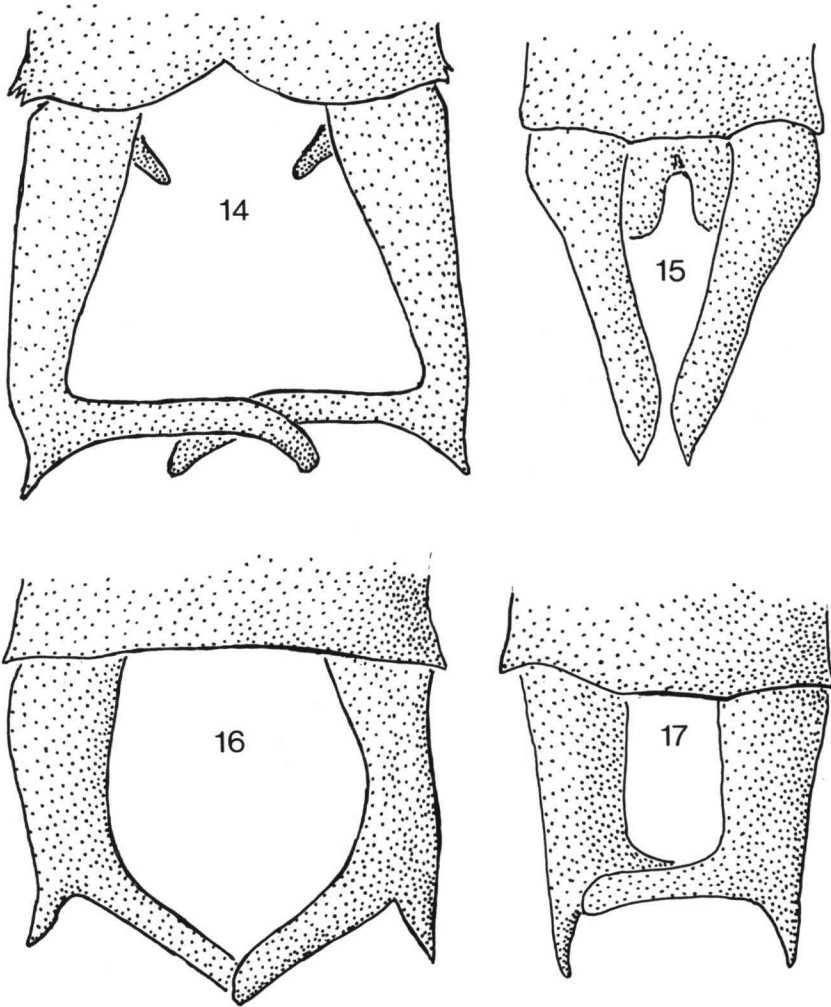


Fig. 14-17. Male abdominal appendages: - (14) *Diastomma tricolor*; - (15) *Gomphidia madi*; - (16) *Diastomma selysi*; - (17) *Diastomma soror*.

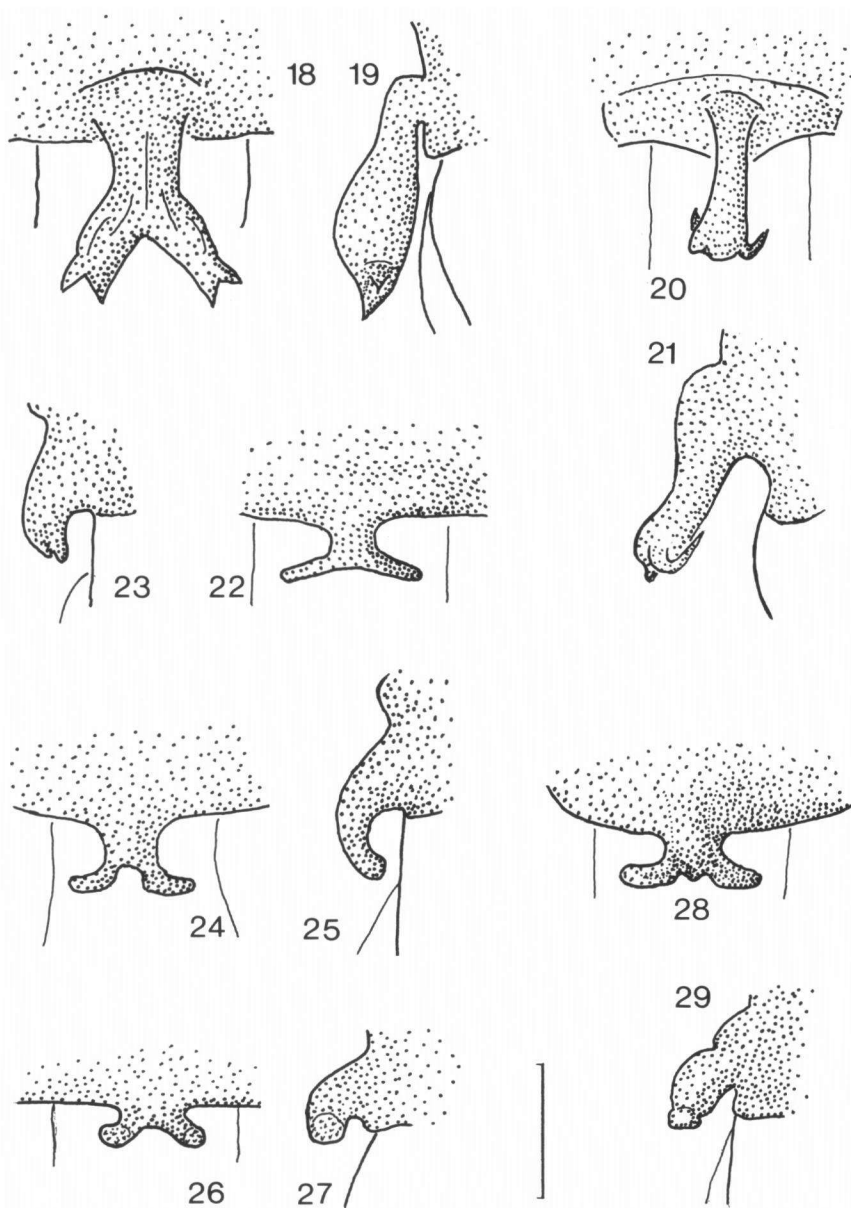


Fig. 18-29. Tubercles of *Diastatomma* (ventral and lateral views): - (18-19) *D. tricolor*; - (20-21) *D. sp. nov.*; - (22-23) *D. soror*; - (24-25) *D. selysi*; - (26-27) *D. multilineatum*; - (28-29) *D. sp. indet.*, from Sierra Leone. Scale = 1 mm.

merely that the two species were the same, which was in any case undisputed. He replied charmingly, expressing great interest, and promising to write again in more detail. But with the pressure of all his other work, he unfortunately never found time to get round to this. So I think we can now revive *Gomphidictinus* as a valid genus, with a single species *G. perakensis* Laidlaw, and intermediate between the other two genera under discussion, also of some special interest as being the only other Lindeniine genus to have a really prominent tubercle, comparable with that of *Diastatomma*. As *Gomphidictinus* is a monospecific genus, the tubercle is of no taxonomic importance here except in helping to validate the genus.

But in *Diastatomma*, where it varies widely, we have a valuable character for separating species, so far usually done by the shape of the superior male appendages, and by the colour pattern. However, abdomens can easily be broken off, especially the posterior segments, and colour seems to vary from yellow to green as the insect ages, also the degree of melanism can vary with the habitat. But provided at least one abdominal segment remains attached to the thorax, HAGEN's tubercle will be there to aid identification.

Here are the tubercles of some of the different species (Fig. 18-29). *D. tricolor* again, the species where it is most prominent, forked terminally, and each branch showing secondary forking; the new species that I am describing elsewhere, also has a prominent tubercle, shaped rather like a human forearm ending in a clenched fist but with the two outer fingers partly uncurled, recurved, and pointing towards the head end; and the others which are all of the same general type as each other, but still with distinct differences, *soror* with a shorter stem and the branches directed laterally, *selysi* with a distinct cleft separating branches otherwise pointing as in *soror*, *multilineatum* with the ends of the lateral branches more rounded and tuberculated; and there is also an unidentified male in the British Museum with most of the abdomen missing, that it would be unwise to describe or name until a complete specimen has been found, but which shows by its tubercle that it is distinct from any other species of which the male is known.

So seeing how important the tubercle is in this genus, I consider that any description of a new species is inadequate which does not give full details of it, and would advise all authors who describe a new *Diastatomma* to pay due attention to HAGEN's Tubercle.

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