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A specimen of the Australian land planarian **Geoplana sanguinea** (Moseley) var. **alba** (Dendy) from The Isles of Scilly

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**A specimen of the Australian land planarian
Geoplana sanguinea (Moseley) var. *alba* (Dendy)
from The Isles of Scilly**

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Introduction

The genus *Geoplana* Stimpson, 1857 contains well over a hundred species, most of which are native to tropical or sub-tropical latitudes. No member of the genus has previously been recorded from the British Isles, though two species of different genera of the Geoplanidae have been recorded. These are *Artioposthia triangulata* (Dendy) recorded by Willis and Edwards (1977) and *Kontikia andersoni* Jones recorded by Jones (1981).

On March 3rd 1980 a worm was found under a wet doormat 'outside a soggy back-door in shade and squalor on an earth path' at Rowsfield, Tresco, Isles of Scilly. This has proved to be a specimen of *Geoplana sanguinea* (Moseley, 1877) *sensu* Graff (1899). This is a species complex and contains several varieties which were previously described as separate species. They are native to Australia and New Zealand. The Scilly specimen has the characters of the variety of *G. sanguinea* that was described as *G. alba* by Dendy (1890), the description being based only on external features.

In view of the variability of the species as defined by Graff (1899) and the inadequate descriptions already published, a full description of the specimen is given so that it may be properly assigned when the current revision (Winsor, personal communication) is complete.

A colony of ten to fifteen specimens was found about a month later than the first specimen, but none were preserved. These were under a flattened, damp cardboard box about 100 m away from the location of the first specimen.

Materials and methods

The specimen was found by Susan Coates and sent alive by Mr. P. Clough of Tresco Abbey Gardens to the British Museum (Natural History). For a short time the worm was kept alive, being fed on earthworms. Its external features were noted and it was killed by allowing it to crawl downwards off an overhanging leaf and thus falling extended into hot 80% alcohol. For histological examination the worm was divided into three parts by transverse cuts. The rear half was cut off, including the mouth and pharynx, and was subsequently sagittally sectioned. A portion about 5 mm long was cut from the rear of the front portion and sectioned transversely. All sections are 10 μ m thick and stained in haematoxylin/eosin. Reconstruction from the sections was by means of successive camera lucida drawings and photographs. The anterior portion was examined by clearing in creosote and is preserved in 80% alcohol. The material is deposited in the B.M.(N.H.); registration number 1980.12.3.11.

In order to compare the Scilly specimen with other specimens of *G. sanguinea*, the holotype of *G. sanguinea* was examined. This is in the B.M.(N.H.) and has recently been sectioned by L. Winsor (Registration number 77.11.2.10). Also in the

B.M.(N.H.) is a large collection of land planarians donated by Dendy in 1924. Amongst these is a collection of eight tubes labelled by Dendy as *G. alba* (Registration number 1924. 8.15.1–10). Two of the eight have additional labels by J. Steel, x, 05 (=October 1905?) casting doubt on their identity. The remaining specimens, twelve in six tubes from various localities, have been examined and one of them from a tube labelled: '*Geoplana alba*, 4 miles E. of Ballarat. W. G. Chalmers. Sept. 1891.' was selected for sectioning as described above for the Scilly specimen.

External features

The living worm was very extensible, being about 80 mm long at maximum extension and 4 mm wide, but contracting down to 30 mm long. When crawling the worm had the approximate cross-sectional shape shown in fig. 1 a.

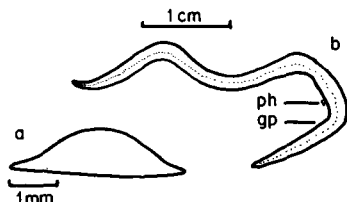


FIG. 1. a. Approximate cross-sectional shape of the living worm. b. Side view of the preserved specimen. ph—pharynx; gp—approximate position of the gonopore.

The colour of the live worm was a uniform pale brown except for the anterior one-sixth of the body which had a distinctive red tinge. The mouth was visible on the ventral surface as a minute transverse slit about two-thirds of the way along the body. The gonopore was visible as a round aperture about 5 mm behind the mouth.

The eyes are small and numerous, forming a continuous line round the anterior tip of the animal and extending posteriorly to the rear of the animal, but being more sparse posteriorly.

The length of the preserved worm was about 45 mm and it had assumed a cross-sectional shape of a flattened oval about 3 mm wide and about 1.3 mm high. The pharynx protruded a little through the mouth, which was about 30 mm from the anterior end (fig. 1 b). The gonopore was 3 mm posterior to the mouth. The anterior reddish tinge had disappeared.

Epidermis and musculature

The epidermis is about 16 μ m thick and the cells are columnar with large basal nuclei. Cilia are not evident on any part of the epidermis, but this is suspected to be a preservation artefact. Cilia may be restricted to a narrow ventral creeping sole, but their extent remains doubtful.

Rhabdites are abundant and are as long as the epidermal cells are tall (16 μ m). Their precise shape is not clear due to overcrowding, but they appear to be quite narrow. Rhabdites appear to be formed in groups internal to the cutaneous musculature, between the bundles of which they migrate to the epidermis.

Underlying the epidermis is a layer of dense cutaneous longitudinal muscle in bundles. Ventrally this is 90 μ m thick, but laterally and dorsally it is only 50 μ m thick (fig. 2, clm). Inside this layer there is a region of loose circular muscle fibres and there are dorso-ventral and transverse (together being radial) muscle fibres running

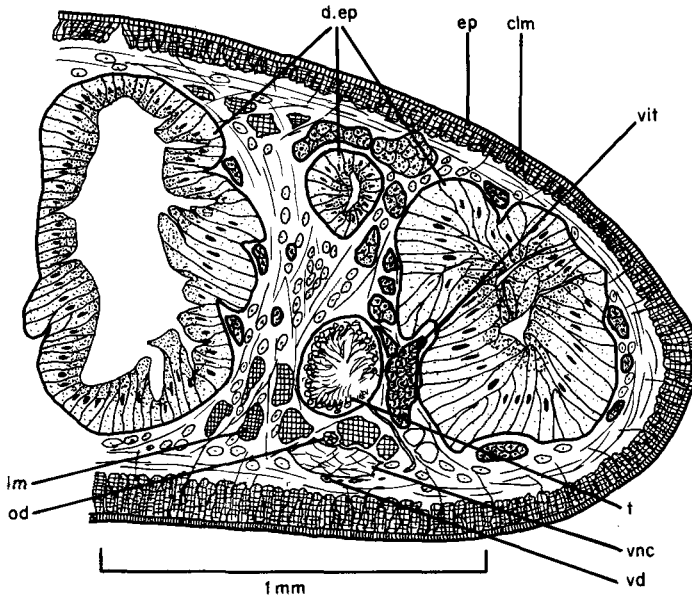


FIG. 2. Diagrammatic transverse section through the mid-region of the body anterior to the pharynx. clm—cutaneous longitudinal musculature; d.ep—digestive epithelium; ep—epidermis; lm—longitudinal muscle bundles dorsal to the ventral nerve cord; t—testis; od—oviduct; vd—vas deferens; vit—vitelline follicles; vnc—ventral nerve cord.

through the parenchyma. There are several distinct compact bundles of longitudinal muscle fibres running just above each ventral nerve cord, but ventral to the testes on either side (fig. 2, 1 m).

Nervous system and eyes

The nervous system consists of two ventral nerve cords (fig. 2, vnc), a number of commissures between them, and an extensive plexus beneath the cutaneous longitudinal muscle amongst the circular muscle fibres. Because the anterior of the worm has not been sectioned the extent of anterior fusion of the nerve cords is not known.

In section the eyes have a diameter of about $18\mu\text{m}$. They lie in the layer of cutaneous longitudinal muscle about $30\mu\text{m}$ in from the basement membrane.

Alimentary system

The anterior ramus of the intestine runs forwards from the pharynx and has numerous pairs of lateral diverticula. The two posterior rami run posteriorly and each has several lateral diverticula. The rami and diverticula are lined with large columnar cells $80\text{--}120\mu\text{m}$ tall, each with a central nucleus.

The pharynx is folded, but its insertion and musculature can be distinguished. The pharynx is not cylindrical since its dorsal insertion lies on the dorsal side of the pharyngeal cavity posterior to the mouth, and the ventral insertion is at the anterior end of the pharyngeal cavity. The opening from the pharynx to the rami lies dorsally.

The pharyngeal musculature is complex and confused due to the folding of the pharynx, but it can be seen to consist chiefly of longitudinal and radial muscle fibres. There is a layer of circular muscle fibres inside the other musculature.

Reproductive system

Female

The position of the ovaries is not known since the anterior portion is not sectioned, nor were they evident after clearing. Presumably there is a single pair. There is an oviduct (fig. 2, od) running along each side of the animal just dorsal to the ventral nerve cord. Each has an internal diameter of $10\ \mu\text{m}$ and is ciliated, with an external diameter of $25\ \mu\text{m}$. There are numerous very short dorsal branches off each oviduct which receive secretions from the extensive vitelline follicles. These latter extend dorsally and laterally when seen in transverse section, and can be seen to extend almost to the posterior end of the animal in sagittal section. How the secretion of these posterior vitelline follicles reaches the oviducts, which do not extend this far, is not clear.

The oviducts run posteriorly to a point behind the gonopore, where they converge, unite and immediately discharge into the female atrium (fig. 3, fa). The female atrium appears to be divided by a slight constriction into two regions. The region nearest to the oviducts also receives the secretion from the shell-gland (fig. 3, sh. g) and then leads into a larger distal region which leads to the common atrium (fig. 3, at). In the specimen a small plug of spermatozoa can be seen in the female atrium, just extending into the opening from the two oviducts. The shell-gland lies around the musculature surrounding the female atrium and extends forwards on either side approximately as far as the gonopore and some way posteriorly from the rear-most extent of the oviducts.

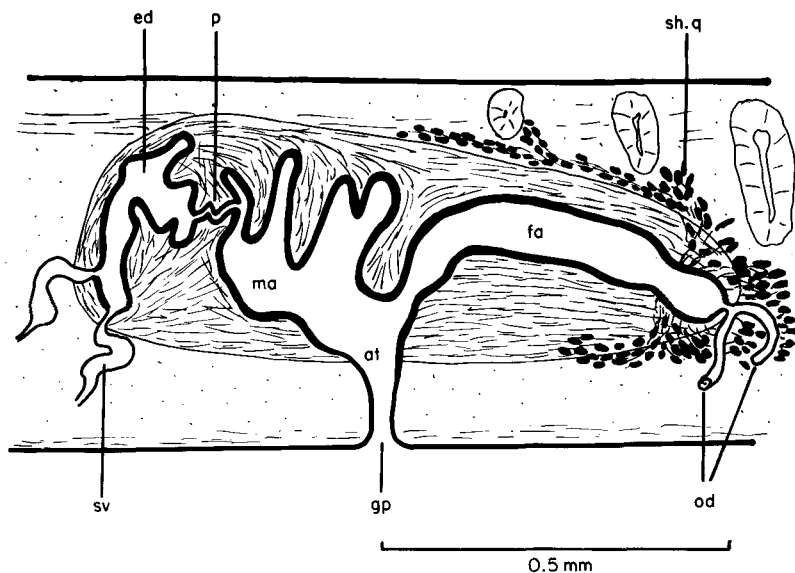


FIG. 3. Diagrammatic sagittal section through the genitalia. at—common atrium; ed—ejaculatory duct; fa—female atrium; gp—gonopore; ma—male atrium; od—oviducts; p—penis; sh. g—shell gland; sv—seminal vesicle.

Male

The testes (fig. 2, t) are numerous and they occur in the region between the anterior end and the pharynx. They lie ventrally but just dorsal to the ventral nerve cord and oviduct on either side of the animal. Each testis is roughly circular and

about 280 μm in diameter. On each side of the animal there are two rows of testes, each row being offset a little from the other so that in some transverse sections parts of two testes can be seen above each oviduct, one slightly to each side. This can also be seen in the cleared anterior portion of the worm by transparency.

A single duct (vas efferens) leaves each testis ventro-laterally and passes round the ventral nerve cord laterally before uniting with the vas deferens which lies immediately ventral to the nerve cord, one on each side of the animal. Both the vasa deferentia and the vasa efferentia have a diameter of 2 μm internally and 12 μm externally. Neither is ciliated.

At a level just posterior to the mouth, each vas deferens broadens considerably, becomes convoluted and packed with spermatozoa and turns dorsally towards the penis. Thus each vas deferens forms a seminal vesicle, though these have been called (Fyfe 1948) false seminal vesicles (fig. 3, sv). Each continues dorsally, enters the muscular sheath surrounding the genitalia, and then discharges into the much folded ejaculatory duct (fig. 3, ed) which discharges through the poorly differentiated penis papilla (fig. 3, p) into the male atrium fig. 3, ma).

The male and female genitalia are surrounded by an extensive muscular bulb, but there is no differentiation in the musculature between the male and female parts, nor between the different male parts.

Discussion

Geoplana sanguinea was described by Moseley (1877) (as *Coenoplana sanguinea* gen. nov., sp. nov.) solely from external characteristics. The length was 7 cm and the width 4 mm. Moseley gave no other details under the specific definition, but the generic definition (of *Coenoplana*) contains the following: 'external longitudinal muscular bundles (=cutaneous muscle) largely and evenly developed over both dorsal and ventral regions. Lateral organs (=ventral nerve cords) distinct and isolated . . . and connected by a transverse commissure. Eyes absent from the front of the anterior extremity and scattered sparsely on the lateral margins of the body for its entire extent'.

'Mouth nearly central, pharynx cylindrical.'

It is clear from this, and indeed Moseley states, that he made some transverse sections, but not necessarily of *sanguinea* since two other new species of *Coenoplana* were described in the same paper.

Examination of the recently cut sections of Moseley's type specimen of *sanguinea* essentially confirms his statement with some relatively unimportant differences. It is also possible to compare the genitalia and other features which Moseley did not include in his diagnosis but which are now taxonomically important.

Geoplana alba was described by Dendy (1890) also solely from external features, but the description includes 'the opening of the peripharyngeal chamber is near to the junction of the middle and posterior thirds of the body' and the colour was described as 'brownish and flesh-coloured all over with beautiful peach coloured tip.' From this admittedly meagre description it seems clear that the Scilly specimen is the same species as that described by Dendy (1890) as *Geoplana alba*. However Graff (1899) synonymized *alba* and *sanguinea*, the latter taking precedence, and suppressed *Coenoplana* Moseley, 1877 as a genus in favour of *Geoplana* Stimpson, 1857. The result is a highly variable species described solely from external features. Using Graff's (1899) criteria there is no doubt that the Scilly specimen is of *G. sanguinea*. However, when the specimen is compared to the type of *G. sanguinea* and to the

description of genitalia published by Fyfe (1948) it is clear that there are some significant differences.

The type of *G. sanguinea*, the specimen of *G. alba* and the Scilly specimen all have similar cutaneous musculature. The Scilly specimen has, however, some longitudinal muscle bundles dorsal to the ventral nerve cords. These are not present in the other two specimens.

The pharynx of *G. sanguinea* is cylindrical in the sections, and is stated to be thus in the generic description by Moseley (1877). The pharynx of the Scilly specimen, and of the sectioned specimen of *G. alba*, is not cylindrical but conforms to the 'glockenformig' type of Graff (1899).

The mouth opens two-thirds of the way along the body of the Scilly specimen and in the twelve examined specimens labelled *G. alba* by Dendy. The mouth of *sanguinea* is stated to be central in the generic description of Moseley (1877).

The testes of the type of *G. sanguinea* lie lateral to the ventral nerve cord on either side of the animal. The testes of the Scilly specimen and of *G. alba* lie dorsal to the nerve cords. It is quite clear that this is a real difference and is not due to different states of contraction.

The type of *G. sanguinea* has a very thin, convoluted ejaculatory duct which discharges through a distinct conical penis papilla. The ejaculatory duct of the Scilly specimen is broad and folded and discharges through an indistinct, blunt penis papilla. This difference is clear and not likely to be the result of variation within a species. The sectioned specimen of *G. alba* seems intermediate in this respect but closer to the Scilly specimen. Fyfe (1948) described the genitalia of specimens identified as *G. sanguinea*, but these also had a broad ejaculatory duct and a blunt penis, being closer to the form of the Scilly specimen than the type of *G. sanguinea*. Fyfe also describes a 'glandular sac' lying ventral to the female strium and opening into the common atrium just inside the gonopore. There is no such structure in any of the three specimens here examined, nor is any equivalent structure mentioned in Graff (1899).

There are then some important differences, at the very least inconsistencies, between the Scilly specimen and the type of *G. sanguinea*. These differences, in musculature and in genitalia are taxonomically important, and it also seems that some doubt must be cast on the synonymy of *sanguinea* and *alba*. To be certain one way or another requires the re-examination of the type material of *G. alba* and a comparison with the type of *sanguinea*. The specimen of *alba* here examined is not a type, merely a specimen identified by the originator of the species and presumably correctly identified as the same. Dendy (1880) apparently did not designate type material, if he did it is now lost. Only when all the type material is compared and re-examined, and perhaps re-designated, as is currently under way (Winsor, personal communication) will the true status of the varieties be known. Hopefully it will be possible to properly assign the Scilly specimen when this full revision is complete. In the meantime it is proposed to refer the Scilly specimen to *Geoplana sanguinea* (Moseley) var. *alba* (Dendy).

The species to which the Scilly specimen belongs clearly originated in Australia, though some *G. sanguinea* have been found in New Zealand (Graff 1899). Tresco Abbey Gardens are renowned for their collection of antipodean trees and it seems clear that the worms were introduced with soil attached to imported plants. There are several other animal species native to New Zealand and Australia that have been recorded from Tresco (Clough, personal communication).

Summary

A description is given of a land planarian found in the Isles of Scilly. The specimen is assigned to *Geoplana sanguinea* (Moseley) var. *alba* (Dendy) native to Australia, but the validity of the species as defined by Graff (1899) must be doubted.

Acknowledgments

It is a pleasure to thank Mr. P. Clough and Miss Susan Coates for finding the specimen and keeping it alive long enough to permit examination. Thanks are also due to Dr. I. R. Ball, Dr. D. I. Gibson and Mr. Leigh Winsor who gave valuable help and advice and to Mr. D. W. Cooper and Mrs. L. Kelly for histological assistance.

Note added in proof

Several specimens of *G. sanguinea* var. *alba* were found in March 1981 in a compost heap in a garden near Poole, Dorset (Grid ref. SZ 043902).

Specimens of yellow or buff planarians have been found in gardens in the vicinity of Belfast, Northern Ireland over several years. Specimens have now been received, the earliest dated 16/ix 1974 from Grid ref. J 3270, and these are also *G. sanguinea* var. *alba*.

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