

Notes on the Structure and Fertilization of the genus *Bonatea*, with a special Description of a Species found at Bedford, South Africa. By J. P. MANSEL WEALE, B.A. Communicated by CHARLES DARWIN, Esq., M.A., F.R.S., F.L.S.

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*BONATEA DARWINII*, sp. n. Foliis vagina elongata concavis, racemo denso, sepalis anticis contortis concavis falcato-acuminatis, extrorsum emarginatis pone petala antica depressis, petalorum parte postica lata patente, stigmatē supra subextrorsum lateraliter canaliculato.

*Tubera* ovato-oblonga. *Caulis* 6 poll. ad 1 ped. altus, undique foliatus. *Foliorum* vaginæ elongatæ caulem arcte includentes, laminæ patentēs, 2-7 poll. longæ, 2-6 lin. latæ, concavæ, lineari-lanceolatæ v. ovato-lanceolatæ; folia superiora abrupte ad vaginas reducta. *Racemus* 6-24-florus, densus. *Bracteæ* membranaceæ, lanceolato-acuminatæ, ovaria arcte vaginantes. *Flores* galeati; galea e sepalo postico concavo segmentisque posticis petalorum anticorum composita; sepala antica contorta, concava, falcato-acuminata, extrorsum emarginata, pone petala antica depressa, petalorum pars antica sepalis æquilonga, usque ad basin bipartita sinu rotundato, segmento postico lineari-lanceolato, subfalcato, antico lato patente ad apicem frontem et tergum versus contorto; labellum tripartitum, lobo medio angusto lineari-filiformi verrucis 3 subinflatis instructo, lateralibus latissimis patentibus falcatis leviter incurvis; nectarium extrorsum curvatum ovario sublongius. *Stigma* quam in *B. speciosa* brevius, carnosum, supra subextrorsum lateraliterque canaliculatum.

*Hab.* Bedford, in damp hollows on banks near watercourses. August and September.

This flower resembles a white Lepidopter, such as *Pieris* or *Anthocharis*, and might truly be called the Butterfly Orchis of South Africa.

The posterior portion of the petals is tinged with greenish; the rostellum and anthers are also yellowish green; the sepals are bright green, and the labellum and anterior portion of the petals pure snow-white.

It is nearly allied to both *Bonatea speciosa* and *Habenaria* (? *Bonatea*) *Saundersiæ*, Harv., to which last it is most closely connected, although differing in the very important point of its petals being divided. It is also, in some respects, allied to *B. Boltoni*, Harv.

I have for some years been busy examining the fertilization of Orchids and Asclepiads in South Africa, but, owing to various reasons, I have been unable to prosecute their study with the uninterrupted attention which is so desirable for a complete and satis-



factory elucidation of the curious facts connected with the agency of insects. I regret that on no occasion have I possessed the plants in a cultivated state, so as to subject them to direct experimentation with the object of testing under a variety of circumstances the causes of the great fertility and infertility of different species. Thus *Disa cornuta*, although very abundant, and producing an enormous number of conspicuous flowers in the neighbourhood of Port Elizabeth, only occasionally bears fertile seeds. In October or November, 1863, my friend Mr. R. I. Miller, of Port Elizabeth, obtained for me a spike of *Bonatea speciosa*. This plant was growing on the sand-ridge to the left of the village of Walmer, and, so far as I am aware, is confined to that neighbourhood at Algoa Bay.

Having read the interesting notices of this aberrant and most curious form in Mr. Darwin's celebrated work 'On the various Contrivances by which British and Foreign Orchids are fertilized by Insects,' published in 1862, I dissected several of the flowers, and made drawings under the microscope with the camera lucida.

But, last year (1865), in the Journal of the Linnean Society, vol. ix. No. 35, I found a paper "On the Structure of *Bonatea speciosa*, Linn., with reference to its Fertilization," by Roland Trimen, Memb. Ent. Soc. London, and the well-known author of "Rhopalocera Africae Australis;" and this again drew my attention to the subject.

In the spring of 1865, near the Koonap River, I caught several specimens of the smaller variety of *Pieris gidica*, and likewise of *P. charina*, with pollinia of some unknown species of Orchid loosely attached to the sternum.

In the present year I captured, towards the end of August, a specimen of ?*Anthocharis Antigone*, which appeared to have some difficulty in flying. On first observing it I imagined that the yellow variety of the female *Thomisus* (? *abbreviatus*, Walck.), Order *Araneida*, had seized this beautiful insect as its prey; but whilst squeezing it in the net, I perceived that unfortunately a pair of pollinia belonging to some orchid had become dislodged from its sternum.

On searching the neighbourhood I found that, together with the hitherto unknown habitat of *Antigone*, I had discovered a new and interesting species of *Bonatea*, which I believe to be as yet undescribed.

The plants were growing on a low bank in a sloping gully amongst a few dried up ferns. Their tubers were barely covered



with loose leafy mould, and they appeared to suffer from the exceedingly dry weather which had so long prevailed.

On the bank were several specimens, most of which had not then blossomed. Those which had were, in almost every instance, deprived of their pollen masses, and the thick creamy layer of pollen on their projecting stigmatic surfaces showed how attractive their conspicuous blossoms were to insects.

The plant was afterwards found growing in abundance on similar spots all along the Bedford River.

The flowers possess no scent, and, although smaller, are much more conspicuous than those of *B. speciosa*, and evidently depend principally upon Rhopalocera for their fertilization.

In every flower examined the nectaries were full up to their mouth of a sweet viscid juice.

In this respect, in their very conspicuous colour, and in the absence of scent they appeared to differ from *speciosa*, Mr. Trimen's remarks on the absence of nectar being confirmed by my own observation.

From this date down to the middle of September this plant was found growing in abundance; and the ovaries of withered plants in every case appeared swollen with seed.

The tiny, but robust, little Skipper Butterfly, *Pyrgus Elmo*, was discovered one morning perfectly embarrassed from the number of pollinia attached to its sternum. Owing to the close contiguity of the masses, and the fact that many of the caudicles are entirely bereft of their pollen, so that merely a fragment with the viscid disk remains attached, I am uncertain as to the number, but believe that from 9–12 remain on my specimen.

I propose in this paper to compare this species with others observed or described by other authors, and from which I believe it to differ in slight details, the adaptation in this genus being apparently very closely connected by a fine series of South-African plants.

Of *Bonatea Saundersiæ* Harvey remarks in vol. ii. fol. 29 of the 'Thesaurus Capensis':—

“Of this very distinct species I have seen but a single specimen, collected by Mrs. Saunders, and given by her sister, Miss Wheelwright, to the Dublin Herbarium. It is quite unlike any South-African species, but seems allied to *H. (Bonatea) gracilis*, Lind., from Peninsular India.”

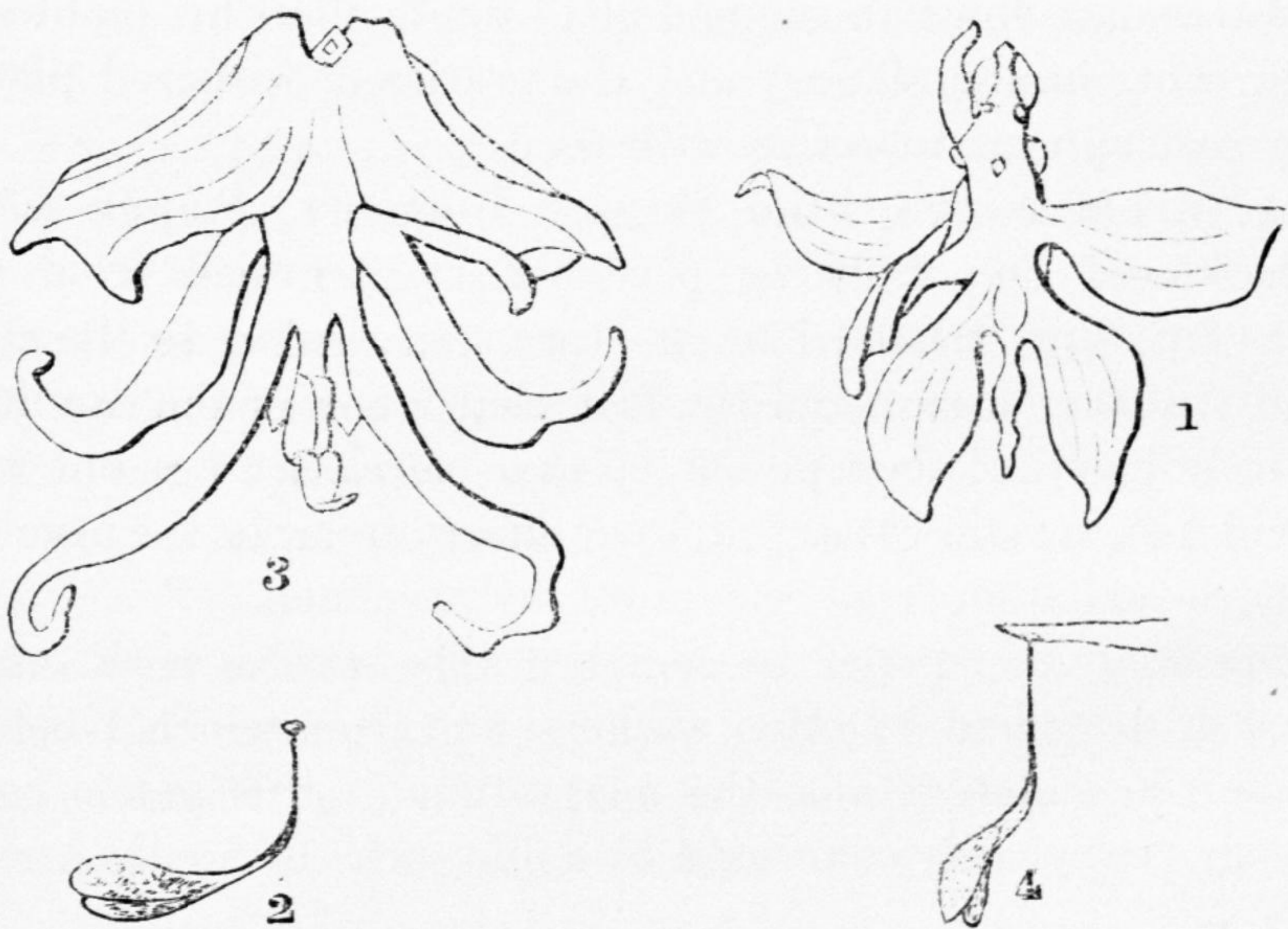
The Bedford *Bonatea* appears to be very closely allied to this interesting Orchid, and to form a connecting link between it and



*Bonatea speciosa*, to which also in many of its characters it bears a close relation.

Like *speciosa* and *Boltoni*, its anterior petals are divided, the posterior portions being relatively of larger proportions. In this respect it differs from *Saundersiæ*, whose petals are undivided, but resembles it in the broad and conspicuous laminae of the anterior portions. Relatively to the breadth of the anterior portions, the posterior are narrower than in *speciosa*.

Its anterior sepals are partially like those of both these plants. Like those of *speciosa*, they are deeply and complicately cleft and falcate, and are united to the labellum with the petals; but, unlike them, they lie in a plane almost at right angles to the anterior petals, and cross their blades behind in a direction almost parallel to the lateral processes of the labellum. Like those of *Saundersiæ* they are decumbent, and show the slightest imaginable inclination to turn upwards at their extremities like those of *speciosa*.



- Fig. 1. Under surface of labellum of *Bonatea Darwinii* (magnified).  
 Fig. 2. Pollinium of ditto in natural position (magnified).  
 Fig. 3. Under surface of labellum of *Bonatea speciosa* (from Mr. Trimen).  
 Fig. 4. Pollinium of ditto (from Mr. Trimen).

The lateral processes of the labellum are even broader than those of *Saundersiæ*, but not so incurvedly falcate, and the medial process is shorter than the lateral, in which respect it differs from *Saundersiæ*, but more nearly resembles *speciosa*.



This shortening of the centre process is due to very different contrivances in the two plants.

In *speciosa* the shortness is produced by three folds inwardly, whilst in this species there are three broad and thick expansions or swellings occupying a position corresponding to the folds in *speciosa*. In *Saundersiæ* the folds are represented by three lax curvatures.

The position of the stigmatic surfaces is also distinct in each. In *speciosa* they project forward beyond the junction of the three lobes of the labellum. In the Bedford species, whilst they are free at their extremities as in *speciosa*, they barely reach so far forward, but in the same direction project forward and outwards. In *Saundersiæ* they appear to be attached to the exterior margin of the lateral processes of the labellum, and are curved at their extremity outwards; but, owing to the inexactitude of the drawing, according to Harvey, too much dependence cannot be placed on their exact form and position.

The posterior sepal, the anther, and the helmet of the rostellum are thrown back at a more considerable angle than in *speciosa*, or even further than in *Saundersiæ*, and its hood is even relatively more expanded than in *speciosa*. This is occasioned by, or is correlative with, the abrupt and almost perpendicular angle which the caudicle of the pollinia forms with the pollen masses.

These last are twisted inwardly and outwardly, so that the viscid disks lie in a more abrupt, but nearly corresponding, plane with the stigmatic processes. While in *speciosa*, after removal, the caudicles become straighter, in the Bedford *Bonatea* they become, if anything, more incurved.

Mr. Trimen was the first to draw attention to the very peculiar peg which is inserted at the mouth of the nectary of *speciosa*. This peg I had already observed in 1863, and at that time made several drawings under the microscope.

In the Bedford species this peg assumes the form of a cup-like lip and is relatively much smaller, while the mouth of the nectary, on the other hand, is by no means so constricted as in *speciosa*.

It appears to me that these parts answer the same purpose in different ways in the two plants.

In the flower of *B. speciosa* the constricted mouth and the peg oblige the nocturnal insects attracted by the strong scent of this flower (which much resembles that of *Hesperanthus* and a species of *Satyrion*, both plants growing in the vicinity) to remain



some time probing its empty nectary ; for my observations in this respect agree with Mr. Trimen's. I found no free nectar in the nectary, although, if I remember rightly, the substance of the nectary was sweetly juicy when sliced open.

In the Bedford species the nectary is generally full of nectar up to the brim, while the flower on the contrary is scentless.

In both plants the viscid matter on the disk hardens slowly, and hence it may be a matter of some importance that an insect visiting a flower should be delayed. In the one case the cheat would probably be quickly detected, whilst, in the other, the abundance of nectar would probably soon satisfy a visitor. I may state here that, so far as my observations go, most of the scented dull-coloured *Iridaceæ* and *Orchideæ* have a great similarity of perfume, and that, whilst the former are very numerous in individuals, the latter are sparsely scattered about.

In *B. speciosa* it is of the utmost importance that the viscid disks should be fixed laterally and backwardly on the head or thorax of the visiting insect; for otherwise the straightened pollinia would have little chance of touching the elongated stigmatic processes.

In the Bedford species the pollen masses were in both instances attached to nearly the centre of the sternum, and easily came in contact with the spatelliform processes, which are relatively much shorter than in *speciosa*.

In the only specimen of *speciosa* which I examined, the pollinia were unremoved in the three flowers which were expanded.

In *Boltoni* the stigmatic surfaces are much inclined upwards, and the anterior portions of the petals project upwards as guides to the insects visiting the flowers.

In *speciosa* both the sepals and petals curve upwards, but in a less marked manner than in *Boltoni*; and, to the best of my recollection (but of this I am uncertain), the stigmatic processes in the full-blown flower have likewise an upward tendency.

In the Bedford species this tendency is only evinced by a slight and insignificant twist at the straightened apices of the anterior petals; and in *Saundersiæ* both sepals and petals are markedly decumbent, the apices being curved, indeed, but very slightly, and in no way upwards.

It will be remarked that I only knew of one spot near Port Elizabeth where *speciosa* could be found; and there it is said to grow but sparsely.

The species at Bedford was numerous; and in almost every case



the many open flowers were thickly fertilized, as though each flower had been constantly visited.

In both the Bedford species and *Saundersiæ* the nectary projects forwards, whilst in *speciosa* it is projected vertically downwards, and in *Boltoni* it is curved inwards (? slightly).

In all, the position of the nectary appears to lie in a plane drawn from the enclosed pollinia downwards.

The hood of the rostellum in *Saundersiæ* presents a marked contrast to the Bedford species in its diminished and almost rudimentary condition.

These notes, I fear, are very imperfect, owing to the scanty drawings I have had an opportunity of examining, and I regret that I am utterly unacquainted with *Bonatea gracilis*, Lindl.

If the species here noted has not as yet been described, I propose the specific name of *Darwini*, in honour of the naturalist from whose works I have derived so much incitement to prosecute the study of living beings.