Ornithophilous Flowers in South Africa
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Ornithophilous Flowers in South Africa.

BY

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With Plate XV.

THE Cinnyridae play a very important part in the fertilisation of some of the Cape flowers. There has been very little published on this point[1], and therefore the following observations on flowers belonging to some thirteen natural orders may be of interest, especially as probably more than a hundred species are largely fertilised by these birds. It is noticeable that the orders are perhaps as different as they possibly could be.

MELIANTHUS MAJOR, L. (Figs. 1–3).

The flowers are exceedingly conspicuous. The peduncle is four or five feet high, and thickly covered for the last eighteen inches by the dark reddish-purple flowers.

The sepals are petaloid and very dissimilar; the superior pair (about an inch long), being slightly curled forwards, protect the essential organs from rain[2]; the lateral sepals are somewhat shorter, and prevent access to the flower from the side; the lowest sepal[3] is hollowed out into a short blunt

[1] Dr. Trimen. Lecture delivered before the Cape of Good Hope Society.

[2] They also overlap behind one another.

[3] The flowers are reversed by the twisting of the pedicel.

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spur, which comes so far upwards in front that it meets the extremities of the petals. These latter are bent forwards at right angles to the flower axis and converge to a point just covered by the anterior border of the lowest sepal. They are united laterally (the lower pair in front also), and hence aid in preventing insect visits from the side [1].

The honey-secreting disc does not surround the essential organs, but is only developed between the bases of the lower pair of stamens. It is very large and cup-shaped, having almost the same shape as the sepaline spur in which it lies, and to which it is united behind and for about a line in front. It secretes an abundance of rich black honey, which sometimes almost fills the cup. The only entrance to this honey is from above, through the horizontal arch formed by the petals.

The flower is protandrous, and shows three distinct stages.

In the bud the four stamens surround the style, with the anthers introrse; but just before dehiscence the superior pair of stamens elongate till their anthers are just below the superior sepals, at the same time twisting so that the dehiscing anthers have their faces turned downwards.

In the second stage the same process occurs with the lower pair of stamens, but the elongation is not so great (see Fig. 2).

In the third stage the anthers are carried outside the flower by a continuation of the twisting process (through another 90°, see Fig. 3), while the style elongates and bends forwards; the minute stigmatic lips also enclose.

I saw the birds (*Nectarinia chalybea*) at work at Duiker Vlei, near Cape Town. They seize the peduncle below the lowest flowers and hop upwards. This is almost invariably their habit with all flowers, and the protandry in this case leads to their cross-fertilising different plants. They let me approach within ten yards, and I could see them, while clinging to the peduncle, take the range of the upright flowers and dip their beaks into the spurs, thus covering the head feathers

[1] The petals have small reflexed extremities. These are covered with hairs, and would perplex any small insects crawling into the flowers.

with pollen in younger flowers or touching the stigmatic lips in older ones.

MELIANTHUS COMOSUS, Vahl.

This flower is not so much specialised as the preceding species. The petals are quite free and more upright, while the spur of the lower sepal is not so marked, and the honey-secreting disc is much smaller. The four anthers also dehisce at the same time [1].

This plant, which grows in the Karoo, is visited by another *Cinnyris* (*Nectarinia famosa*).

MELIANTHUS DREGEANUS, Vahl.

Visited by *Zosterops virens* near Seymour, Stockenstrom (*fide* Mr. W. C. Scully).

LEGUMINOSAE.

SCHOTIA SPECIOSA, Jacq.

The flowers are protogynous; the pistil is usually flaccid when the anthers have all emerged from the perianth.

The bright scarlet flowers are very conspicuous. Mr. W. C. Scully watched the birds (probably *C. chalybea*) at work on this plant.

ERYTHRINA CAFFRA, D. C. (Figs. 4–5).

The vexillum in this flower is very large and a brilliant scarlet, while the alae and carina are small and have no lever action whatever. The alae protect the honey from rain and insects as they overlap above the carina. The latter forms a sort of cup (see Fig. 5) in which the honey is held [2].

In the bud the stamens and style are enclosed in the vexillum: as the flowers ripen a sudden bend takes place in the staminal column, so that the stamens and style become nearly

[1] It appears to me probable that *Aitonia capensis*, or some similar form, may have been the ancestor of which *Melianthus comosus*, and then *M. major*, are the specialised descendants.

[2] The lower edges of the carina are united to keep in the honey.

parallel to the peduncle. The stamens diverge considerably and curve upwards in this condition. Hence in this state the end of the leafless peduncle is surrounded by a sort of brush of stamens.

The bird, as it hops along the peduncle and plunges its beak into the carina beneath the alae, has its breast well dusted with pollen; but it cannot effect self-fertilisation, as (see Fig. 4) the terminal portion of the style is abruptly bent towards the vexillum.

Subsequently both the stamens and styles, losing their upward curvature, bend still more downwards towards the peduncle until the style is so straightened that the stigma will touch the bird's breast when it approaches along the peduncle.

All the Nectariniae (and *fide* Mr. Scully *Zosterops virens*) are excessively fond of this flower, and apparently it wholly depends on them for pollination. Mr. E. S. Galpin tells me that 'the bird puts its beak in the opening on top of the staminal column, and runs it along the latter, thus raising the stamens.' Unfortunately I have not been able to test this interesting observation.

ERYTHRINA INDICA, L.

I was able to study the arrangement in this species in Mauritius. Fundamentally the structure is the same. A peculiarity, however, is the peculiar thickening of the upper borders of the carina, which renders entrance still more difficult. The nectary consists of ten small prominences enclosed by the staminal column. Though the stigma is bent over in the same way, I found, in the flowers I examined, that it lay below the level of the anthers. Not being in its natural habitat, I could not study its fertilisation, but in Mauritius it is certainly ornithophilous.[1]

SUTHERLANDIA FRUTESCENS, R. Br. (Figs. 6–8).

This flower shows the same excessive length of vexillum (15–16 lines) and reduction of alae (5–6 lines) so noticeable in *Erythrina*. In the bud, the flower has the characteristic ap-

[1] In a species of *Erythrina* described by Belt, 'Naturalist in Nicaragua,' p. 130, the flower axis seems perfectly straight, though the flowers are ornithophilous. Cf. also *E. velutina* and *E. cristagalli*. Hildebrand, Bot. Zeit. xxviii. p. 621.

pearances of a brush piston flower, like that of some vetches for instance. The vexillum covers the sides of the flower, overlapping laterally in front of the carina. There is a distinct pouch at the tip of the carinae enclosing the anthers which are packed in two whorls, with the usual difference in length of filament and size of anther in each whorl. The pollen is shed on a brush of hairs covering the inner face of the style[1].

When the vexillum opens, the whole mechanism of the flower becomes looser; the carina elongates and its pouch becomes obliterated, and the style grows with the carina, still bearing the pollen on its hairs.

On depression the style simply emerges. The alae take no part in depressing the carina, though possibly their auricles, which pass backwards under the claw of the vexillum, make the motion more steady and regular[2].

The flowers are much visited by *Cinnyris Nectarinia famosa* at Brakfontyn, near Beaufort West, in the Karoo (Miss Jackson).

ERICACEAE.

ERICA PLUKENETII, L.

The pendulous flowers form dense clusters at the ends of the branches. The corolla is ten lines long, narrowing to the throat. The anthers hang completely out of the corolla, extending to fully half an inch from the entrance (so that the distance from their extremities to the base of the flower is sixteen lines, which is exactly the length of beak of *Nectarinia chalybea*).

The stigma is about a line below the anthers, and so comes first in contact with the birds' heads. Honey is secreted by nectaries at the base of the flower.

This is abundantly visited by *N. chalybea* on the hills near

[1] Stigma protected from its own pollen by a small stiff ring of hairs.

[2] This flower seems to me very probably a modification of some such type as *Lessertia pulchra*, which is practically in the same condition as *Sutherlandia* before unfolding of the vexillum.

Cape Town. The bird always seizes the branch below the flowers, and exhausts one branch before going to another. It is an important article of diet to the birds, as it blooms practically all the year.

Probably the whole *Gigandra* section of *Erica* is ornithophilous except *E. penicillata.*

ERICA PURPUREA, Andr.

The flowers are purplish red, and are arranged almost horizontally. The corolla tube is much curved upwards, and about an inch long; it is also very viscid externally, thus keeping off insects. The style projects 2–3 lines from the throat of the corolla, while the laterally placed stamens are included in its tube.

The nectary consists of small projections from the base of the ovary, placed between the stamens.

I have often seen the flowers visited by *Nectarinia chalybea* at Wynberg Butts and Muizenberg. Owing to the upward curvature the bird has to seize the branch above the flowers and suck them head downwards. This is an advantage for the flower, as self-fertilisation is quite impossible, while in *E. Plukenetii* it must occasionally happen.

Probably the whole *Pleurocallis* section is ornithophilous. All the large flowered Evanthes are almost certainly so.

The section *Bactridium* is particularly adapted to bird-fertilisation; the rare *E. fascicularis* (Fig. 9), for instance, which grows on the summits of barren rocky hills near Houwhoek. The stems are three or four feet high without branches, and crowned by a thick whorl of scarlet flowers about sixteen lines long. I saw many birds near them, but had no time to watch them at work.

TECOMA CAPENSIS, Lind.

The stigma stands in front of the stamens with the lips horizontal, so that self-fertilisation is impossible.

I have seen this visited by *Nectarinia afra* in the Fish River Bush. It is also visited by *Zosterops virens* (*fide* W. C. Scully) and *C. amethystina.* Near East London I found numerous bees visiting the flowers. Mr. M. S. Evans has already pointed this out as an ornithophilous flower (*Nature,* vol. xviii. p. 543).

LYCIUM TUBULOSUM, Nees.

This plant is a tall shrub or small tree, with drooping white flowers. The corolla is ten lines long and considerably curved. The stigma is always in front of the stamens, so that cross-fertilisation is ensured. Honey is secreted by the base of the ovary.

I found it was abundantly visited by *Nectarinia chalybea* on the banks of the Little Fish River, near Somerset East. It is also much visited by *Apis mellifica* and other Hymenoptera, who crawl bodily into the flower. Various Coleoptera also visit the flowers.

LOBOSTEMON MONTANUM, Buek.

This plant is a shrub some four or five feet high. The leaves are crowded at the ends of the branches, and these latter being very close together, the bush forms a sort of domed cushion closely covered by pale purple flowers.

The flowers are distinctly irregular: the posterior lobes of the corolla are shorter than the anterior and the stamens of unequal length [1].

Honey is secreted very abundantly by a fleshy ring round the ovary, sometimes filling the corolla-tube to a depth of two or three lines. Insects are kept out largely by a ring of hairs springing from the base of the filaments (and corolla) which surrounds the style. The whole plant is excessively hairy, and the corolla externally viscid.

Though this flower is not specially adapted to birds, I have often seen it visited by *Nectarinia chalybea* sucking honey, and also by other birds (? *Promerops caper*) near Muizenberg. Insect visitors moreover are very rare.

The nearly allied *Lobostemon fruticosum*, Buek., is always covered by insects. The following I have gathered myself. Coleoptera: *Anisonyx ursus* always very ab., *Anisonyx longipes* ab., *Dichilus dentipes*, *D. simplicipes*, *Peritrichia capicola*, and others which I cannot name. Hymenoptera: *Ceratina subqua-*

[1] The shorter stamens twelve lines long, and the others thirteen or fourteen lines.

drata, Xylocopa caffra, Apis mellifica, Tetratonia longicornia. Lepidoptera: several species and numerous Diptera.

LABIATAE.

LEONOTIS OVATA, Spreng.

The flowers are arranged in two or more dense whorls separated by rather long internodes. The calyx tube is long and excessively rigid: the most remarkable peculiarity in the corolla is the almost rudimentary condition of the lower lip: the upper lip, which is of the usual Labiate type, forms a sort of roof protecting the stamens from rain.

The whole outer surface of the corolla is covered with long foxy-red hairs: these probably keep off unnecessary insects (in conjunction with the usual ring of hairs within the corolla just above the ovary).

Cross-fertilisation is ensured by the position of the stigma always above and in front of the stamens. Both style and stamens are covered by the upper lip of the corolla. Honey is very abundantly secreted by a very large nectary of the ordinary Labiate type. The distance from the stigma to the nectary is about sixteen lines, which is exactly that of the beak of *Nectarinia chalybea.* The flower is also curved with the same curvature as that of the bird's beak.

I found *Nectarinia chalybea* sucking the flowers on the Kagaberg, Bedford. The bird grasps the bare stalk below the whorl, then rapidly sucks all the flowers of the whorl, and hops up to the next internode, or more usually flies to another plant. Also visited by *Cinnyris Kirkii.*

The flowers are also visited by numerous bees, *Apis mellifica* and others, but these, unless when gathering pollen, cannot produce fertilisation[1].

SALVIA AUREA, L. (Figs. 19, 20.)

The plant is a shrub three to six feet high, and bears a pro-

[1] The withered lower lip prevents their obtaining a convenient entrance. I saw one bee repeatedly miss the opening and then fly away in disgust. The rigidity of the calyx (the distinctive character of the genus), colour and inflorescence, are all ornithophilous adaptations.

fusion of reddish yellow flowers. There are some very peculiar features about this flower. The lower lip of the corolla is withered and bent back just as in *Leonotis*. The two side halves of the upper lip, moreover, are bent downwards so that they touch one another, thus completely enclosing the anthers. The lever arrangement is very perfect: the short stout filaments of the stamens are about three lines apart, and this interval is completely blocked by the broad spoon-shaped barren lobes of the connective[1]. The style projects about one and a-half lines out of the upper lip, and is curved forwards. The nectary forms a sort of cushion two lines in diameter and one line high, on the top of which are the nullets.

I found this flower was visited by *Zosterops capensis* in the Cape Town gardens. I could see the process distinctly as it was within two yards, and cross-fertilisation is certain. I have also seen wild plants near Seapoint visited by birds (not Nectariniae) taking sips at the honey. I have never seen insects on it though I have watched it several days at different times for an hour or so, and it is probably truly ornithophilous like some other Salviae[2].

SARCOCOLLA SQUAMOSA, Bth.

The flowers are bright scarlet and closely packed together at the ends of the branches. Both the corolla-tube and involucral bracts are excessively viscid, so that insects are largely kept out.

The corolla-tube is about one inch long, and the free ends are scarlet and bent outwards. The stamens converge together and are united to one another and the style just below the stigma. When pushed apart by a needle a cloud of pollen is scattered from the anthers. The anthers in older flowers drop off outside the corolla as the stamens bend outwards till the anthers are beyond the corolla-tube. Honey is abundantly secreted by the base of the ovary.

[1] Each of these is one and a-half lines broad; there is an oblique depression on the inner side at the end of the filament. In the centre of this depression is a small peg attached to the connective.

[2] Cf. F. Müller, Bot. Zeit. xxviii. p. 274.

This flower I have often seen visited by *Nectarinia chalybea*, while insect visits are rare. Self-fertilisation is almost impossible from the superior position of the stigma.

The other species of *Sarcocolla* are almost certainly ornithophilous.

PROTEACEAE.

A large number of the species of *Protea* seem thoroughly adapted to bird fertilisation. The collection of the flowers into a head surrounded by closely fitting and frequently sticky involucral bracts forms a sort of natural drinking-cup. *Promerops caper* in fact appears to live almost entirely on the food so provided by the various species of this genus.

PROTEA INCOMPTA, R. Br. (Fig. 13.)

The involucral bracts in this species are peculiar. Their length increases from without inwards, and the most internal, which are five or six inches long, have their ends turned inwards, and as these bent edges are somewhat woolly, they form a convenient alighting place for the bird. The calyx shows the usual division into a narrow free sepal with a sterile stamen, and a portion formed by the union of the other three sepals bearing the three fertile stamens.

The calyx is expanded below the ovary, then narrows to a diameter of one line or so, while the last inch and a half is much wider and very hard and horny[1]. This last portion includes the anthers, which are closely pressed against the style. The anthers end in small scarlet barren extremities. These scarlet tips lie upon the stigmatic portion, and keep off the plant's own pollen. That part of the style which is in contact with the anthers has a peculiar structure (see Fig. 13).

It is marked by eight horny ridges which show a very strongly developed cuticular epidermis. The hollows between these ridges are occupied by the loculi of the anthers. When the free sepal is loosened from the other three by the elonga-

[1] This portion is in this species very woolly, thus keeping off insects.

tion of the style, the style is left with all this grooved portion covered with pollen. The minute stigma at the top cannot receive any of this pollen, although the separation of the sepals is almost explosive.

The bird, standing on the edge of the involucral bracts, dips its head repeatedly into the cup to suck the honey with which it is full. In so doing, it rubs against the rigid pollen-covered styles, and will also first touch several of the stigmatic extremities.

Both *Promerops caper* and *Nectarinia chalybea* act in this way, but the former is the commoner. Insects are also abundant, and no doubt assist in fertilisation. Very common forms are—

Diptera. *Camponotus niveosetosus*, etc.

Coleoptera. *Lytta nitidula*, and three other species which I have not been able to name.

PROTEA MELLIFERA, Thun. (Fig. 10.)

The heads are five inches long and two and a-half inches in diameter. The involucral scales are pointed and very sticky. The mode of fertilisation is similar to that of *P. incompta* [1].

Promerops caper very common on this species, and also *Nectarinia chalybea.*

Insects are also common, e. g.—

Coleoptera. *Anisonyx ursus*, ab., *Dichilus simplicipes*, *Scymnus*, sp., and four other species which I cannot name. I have also seen *Apis mellifica* flying round the heads and sucking the honey which exuded between the bracts.

PROTEA LEPIDOCARPON, R. Br.

Fertilisation almost identical with the preceding.

Visited by *Nectarinia chalybea.*

Insect visitors: Coleoptera. *Trichostella capensis*, *Platysoma capensis*, and six unnamed species.

[1] The ovary in this form is covered by a dense brush of beautiful golden brown hairs. I was unable to imagine the use of these hairs, as they are completely enclosed by the calyx, but I have often found the ovary destroyed by a beetle grub, and have no doubt that these hairs are to protect the ovary from its ravages.

PROTEA LONGIFLORA, Lam.

Visited by *Promerops caper*, near Houwhoek.

PROTEA GRANDIFLORA, Thun. (Figs. 11, 12.)

In this form the style elongates very greatly, and before it finally bursts the calycine envelope becomes greatly curved. When the separation finally takes place, the style straightens by its own elasticity, and a cloud of pollen is scattered. The stigma in this form is obliquely placed, while the furrows on the style are not so evident as in the other forms.

Visited by *Nectarinia.*

PROTEA CORDATA, Thun. (Fig. 16.)

I have not seen this species fertilised. The stigma lies in a minute slit at extremity of the style, while the anther-case has more the form found in *Serruria.*

PROTEA SCOLYMUS, Th.

Is quite similar to *P. mellifera.*

LEUCOSPERMUM CONOCARPUM, R. Br. (Figs. 17, 18.)

The flowers are closely packed together on the spherical capitulum. The bracts of all the flowers are well developed, and their ends are flattened out and modified somewhat like the bracts of a fir-cone. Out of the hemispherical surface formed by them projects part of the calyx and styles of the flowers. The cavities occupied by the bases of the flowers are narrow and much choked by a profusion of white hairs springing from the bracts.

The calyx ends in four horny lobes (all equal) closely applied over the end of the style. The anthers, opposite these lobes, are also attached to it. The end of the style is much swollen, but the swelling is pear-shaped (not cylindrical as in *Protea*), and scarcely grooved at all. At its narrow upper extremity are two slight horizontal ridges, between which lies the stigmatic slit. The pollen is shed all round the upper surface of the swollen style. It cannot fall

downwards, as the short filaments of the stamens are thickened in such a way that they completely embrace the lower half of the pear-shaped swelling (Fig. 18).

The style lengthens greatly after the calyx has attained its definite growth, and in consequence is thrown into a curved strained position. When it bursts the calyx, or is torn apart by the bird probing the flower, a slight explosion aud scattering of pollen takes place.

Rather to my surprise, I saw a pair of the *Nectarinia chalybea* carefully going over the heads of this plant. They were catching insects, but appeared also to suck the honey. Beetles also visit the flowers, e. g. No. 173, *Pallena*, nov. sp., and a *Hedybius*.

L. hypophyllum, R. Br., and *L. diffusum*, R. Br., agree in all important points with the above species.

Leucospermum nutans, R. Br. (Figs. 14, 15.)

In this form the style is further differentiated. The swollen end of the style instead of sloping upwards ends in a flat top, in the centre of which are two slight ridges protecting the stigmatic slit. The pollen is shed on this flat surface.

Antholyza aethiopica, L.

The five lower perianth-segments are turned backwards, whilst the upper, which is larger than the others, forms a roof over the stamens.

The flowers are distinctly protandrous. All the stamens are turned so as to dehisce downwards, and the style branches subsequently unclose and move downwards between the stamens, so as to lie a little below the anthers.

Self-fertilisation is possible therefore if all the pollen has not been removed in the earliest condition.

After very tedious watching on different occasions, I was able to see birds at work on this flower, though not so clearly as I could wish. The length from stigma to base of ovary is sixteen lines, as usual in bird-flowers. Bees may often be

seen collecting pollen on this flower, and they may produce fertilisation, but the whole structure of the flower is ornithophilous.

A. prœalta, Red., is exactly similar to this species.

BABIANA RINGENS, Ker.

I am strongly inclined to place this amongst ornithophilous flowers, though I cannot certainly say I have seen the birds at work. The bright scarlet colour, the length (sixteen lines) from style to ovary, and the general appearance of the flower, are all in favour of its being ornithophilous, but I could never see the birds actually on the flowers.

NOTE ON HABITS OF CINNYRIDAE.

A point not, I think, usually known about the sunbirds is that they are excessively good fertilisers. They do not as a rule mix their honeys, but keep to one flower at a time in the same way as a bee. It is also easy to see how their habits arose. They are all in part insect-eaters. I kept *Nectarinia souimanga* in a cage for nearly six weeks, and found it was very expert in catching flies (unfortunately it died in the Red Sea on the way home), and there are all the degrees from several insect-eating birds, which only occasionally take a sip at honey, to the typical Nectariniae. *Zosterops virens* would in such a series be the connecting link in habit.

The most important species at Cape Town are *Nectarinia chalybea* and *bicollaris*, and *Promerops caper*. I found that *Promerops Gurneyi* replaces *P. caper* in the Eastern Districts of the Cape Colony and in Natal. *Nectarinia famosa* spends the season from December to April in the Karoo, while from December to April it appears to go to the Knysna and East London.

I am led to entirely disagree with Mr. Wallace's[1] opinion that the colour of flower-seeking birds is quite unconnected

[1] Wallace, 'Darwinism,' pp. 335, 336.

with their habits. As a matter of fact a peculiar shade of red found on the breast of *Cinnyris chalybea*, *C. afra*, *C. famosa*, *C. souimanga*, and *C. bicollaris*, is exactly the same as that which I found in the majority of ornithophilous flowers of South Africa. It is, moreover, not a common colour in flowers; and since Labiatae, Aloes, Irids, and Leguminosae all assume it when they become ornithophilous, some reason must be shown why the simple explanation given by Darwin should be set aside while no other is offered.

No one who has watched the male *Cinnyris* displaying himself in the sun can doubt that he has a distinct, even inordinate, knowledge of his own beauty.

The female apparently quite coincides with him; and considering that (as every one who has studied birds in the field admits) the sight of birds is relatively far keener than our own, Darwin's theory of sexual selection is quite satisfactory, and certainly deserves serious disproof by facts, not opinions.

EXPLANATION OF FIGURES IN PLATE XV.

Illustrating Mr. Scott-Elliot's paper on Ornithophilous Flowers in South Africa.

Melianthus major.

as, anterior; *ls*, lateral; *ps*, posterior sepal; *ap*, anterior, and *pp*, posterior petal; *hd* nectarial cup; *st a*, anterior, *st p*, posterior stamens; *o st*, rudiments of 5th stamen; *sty*, style; *ol*, lobes of ovary.

Fig. 1. Flower with four sepals removed.

Fig. 2. Longitudinal mesial section of flower in second stage.

Fig. 3. Stamens and style in third stage.

Erythrina caffra, D. C.

Fig. 4. Whole flower in first stage.

Fig. 5. Longitudinal section of basal part, vexillum being removed.

se, sepals; *ve*, vexillum; *al*, alae; *car.* carina; *sti.* stigma.

Sutherlandia frutescens.

Fig. 6. Whole flower with vexillum depressed as in fertilisation.

Fig. 7. Flower after sepals and vexillum have been removed.

Fig. 8. Flower with right half of vexillum, right alae and right half of carina removed before unclosure of vexillum.

Lettering as above, *h. r*, special ring of hairs round stigma; *p r*, pollen covered hairs.

Erica fascicularis.

Fig. 9. Flower in longitudinal mesial section; *n*, nectarial prominences; *ov.* ovary.

Protea mellifera.

Fig. 10. Single floret removed from head, natural size.

se_3, three united sepals; *s. sh*, sheath containing anthers *an*, and originally enclosing *cyl*, cylindrical grooved portion of (*sty*) style covered with pollen; *t*, hairy tip of sepals; *se.* odd sepal with barren anther ending in scarlet tip, *ti*; *sti*, stigma.

Protea grandiflora.

Fig. 11. Whole flower removed from head.

Fig. 12. Obtuse stigma.

Protea incompta.

Fig. 13. Section of cylindrical grooved part of style. *sk*, semicircular sclerenchymatous bands.

Leucospermum nutans.

Fig. 14. Whole flower.

Fig. 15. Longitudinal section through thickened end of style and sepaline sheath.

se, over-arching roof of sepals; *sta*, stamen; *p*, pollen; *fil*, filament thickened to clasp style; *sti*, stigmatic slit.

Protea cordata.

Fig. 16. End of style much enlarged.

Leucospermum conocarpum.

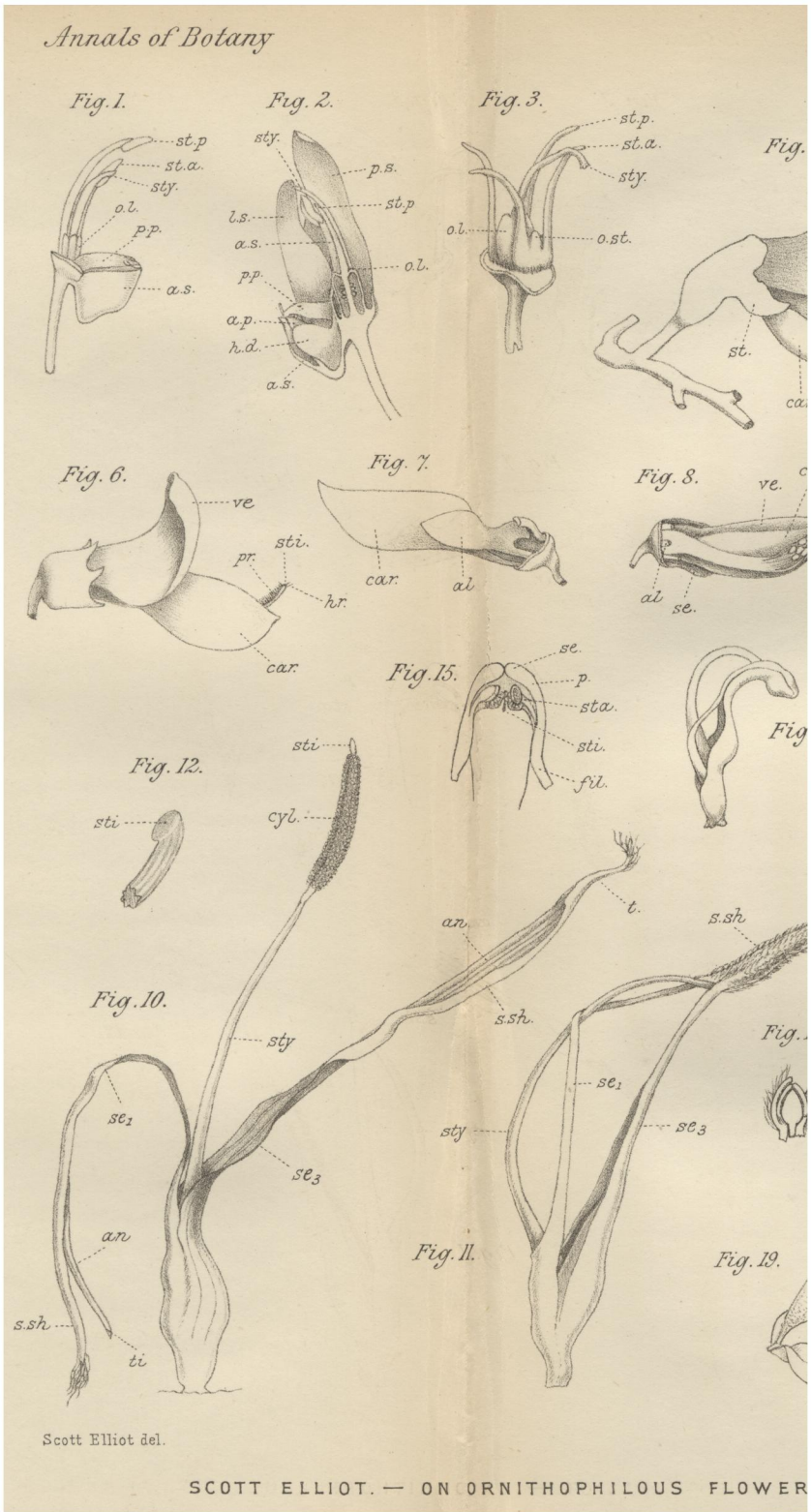
Fig. 17. Extremity of style much enlarged.

Fig. 18. End of sepal sheath with stigma enclosed by stamens and sepals.

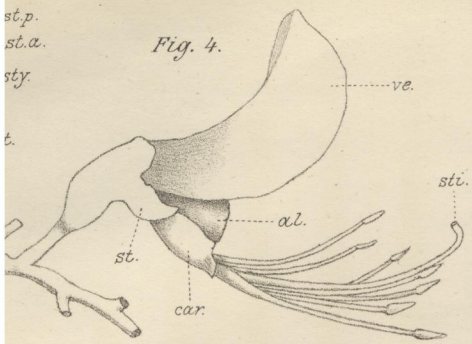
Salvia aurea.

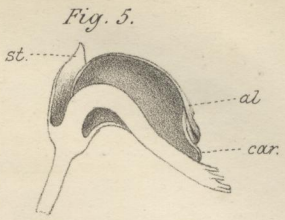
Fig. 19. Flower from side.

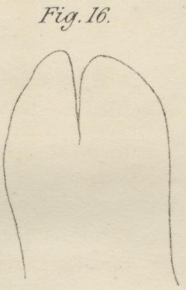
Fig. 20. Lever apparatus.

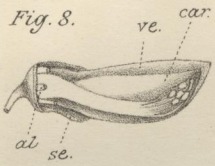


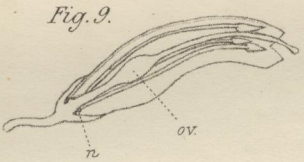
SCOTT ELLIOT. — ON ORNITHOPHILOUS FLOWER

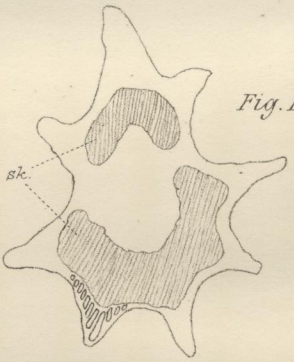


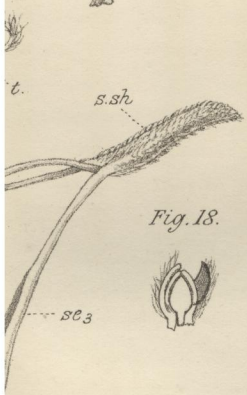












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LOUS FLOWERS.