Order.—ORCHIDEÆ.

39. *Corysanthes rivularis* (Hook., f.), gullies near Dunedin and Stewart Island.

40. *Chiloglottis traversii* (F. Muëll.), Swampy Hill, 2,000 feet.

Order.—LILIACEÆ.

41. *Dianella intermedia* (Endl.), Chain Hills (A. Purdie).

42. *Anthropodium candidum* (Raoul. Choix), common.

Order.—CYPERACEÆ.

43. *Uncinia ferruginea* (Boott), damp ground near Dunedin.

44. *Carex raoulii* (Boott), Stewart Island.

45. *Carex lambertiana* (Boott), near Dunedin.

ART. LXXIX.—*On the Fertilization of* Selliera. By T. F. CHEESEMAN, F.L.S.

[*Read before the Auckland Institute, July 3rd, 1876.*]

THE singular cup-shaped covering, generally known as the indusium, that surrounds the stigma in the *Goodeniaceæ* has long been recognised as playing an important and probably somewhat varied part in the fertilization of the plants composing the order; but nevertheless, so far as I am aware, no one has yet indicated the exact way in which this takes place in any one species. As one member of the order—*Selliera radicans*—is abundant near Auckland, I have been enabled to make a few observations that bear upon the subject, and consequently take this opportunity of placing a *resumé* of the results obtained before the Institute.

Selliera radicans is a common plant in salt marshes along the whole of our coast-line, but is rarely found inland. It has a stout creeping stem, thick and succulent dark green leaves, and small white flowers, that are abundantly produced during the whole of the summer months, often whitening a broad band near high-water mark at the head of many of our shallow bays and inlets. The corolla is split to the base at the back, the five lobes all turning to the front, thus giving the flower a peculiar one-sided or incomplete appearance by which the plant can be readily identified.

If a young flower-bud, some days before it is ready to expand, is examined it will be found that the corolla lobes cohere by their edges, that is, are valvate. The five stamens form a ring in the centre of the flower, closely surrounding the style, than which they are a little higher. The style, as is usual in the order, is terminated by the widely expanded cup-shaped indusium, in the base of which the stigma, as yet quite young and immature, is hidden. As the flower approaches expansion, the stamens, at first erect, arch over the indusium; each anther case splits along its inner

face, and the contained pollen slowly drops into the gaping indusium immediately below. The corolla then ruptures at the back, and gradually opens, the five lobes, as stated above, all turning towards the front. At the same time the stamens elastically curve towards the back of the flower, and ultimately protrude, in a withered condition, out of the posterior slit of the corolla. Meanwhile the lips of the indusium have closed together, thus firmly shutting up the pollen as if it were in a box ; and the style, instead of being, as before, perfectly erect, is now considerably bent down towards the front of the flower. It will now be noticed that the flowers are sweet-scented, and that a small drop of nectar always exists at the base of the style.

In the meantime the stigma has been slowly growing upwards, consequently pushing before it the whole of the pollen, and ultimately forcing it out, bit by bit, from between the closely appressed margins of the indusium. If the pollen were to drop directly to the bottom of the flower, it would be impossible for fertilization to take place, but as the margins and sides of the indusium are furnished with a few weak hairs a portion at least is detained on the outside of the indusium for a time. The stigma still continues its growth, and when mature and ready to receive the fertilizing pollen protrudes considerably beyond the indusium. It is then imperfectly two-lobed, and is plentifully covered with rather viscid cellular papillæ.

I think it will now be evident that self-fertilization cannot possibly take place ; for, long before the stigma reaches maturity, the pollen has been thrust out of the indusium ; and although, as we have seen, it may be detained for a time by the hairs on the outside of the latter organ, yet every vestige has disappeared before the stigma is in a fit condition to receive it. As the plant regularly produces an abundance of fruit, we are naturally led to the supposition that some means exist by which pollen is transferred from the younger flowers to the older ones.

I have already alluded to the presence of nectar, and to the odour exhaled by the flowers. Can we suppose that these attributes are of no purpose in the economy of the plant? Hardly. There is a well-known axiom, that there is no effect without its cause. In this instance the cause of the presence of both nectar and odour is, that insects require to be attracted to the flowers, in order that the pollen may be regularly and efficiently transferred. That the attraction held out is amply sufficient, is proved by the fact that it is only necessary to watch the flowers for a short space of time, on a bright and sunshiny day, to observe that they are visited by numerous insects, all busily engaged in feeding upon the nectar.

The insects are of various Orders, but I believe that fertilization is chiefly effected by a species of *Diptera*. The method pursued appears to be

as follows:—The fly alights on the front of the corolla, which forms an excellent landing-place, and creeps a little way into the flower, at the same time bending down its head, so as to reach with its proboscis the nectar at the base of the style. If the visitor be of the right size (a species approaching the common house-fly in this respect seems to suit the requirements of the flower the best), it will inevitably strike its head against the bent summit of the indusium. Should the flower have been expanded for some time, probably nothing will be effected; but should it be one in which the stigma is thrusting the pollen out of the indusium, the insect cannot fail to get the back and front of its head plentifully dusted over with pollen. Let it now visit another and *older* flower, and it is evident that when occupying the same position as before, that the part of its head which had then rubbed against the extremity of the indusium, will now strike against the stigma, which, as we have seen, protrudes beyond the indusium when mature. In this case the pollen would adhere to the viscid papillæ with which the stigma is covered, and fertilization would be ensured.

If this view of the fertilization of the plant be accepted, we can readily see the meaning of several facts that would otherwise remain without explanation. For instance, the sudden and elastic movement which the stamens make to the back of the flower immediately after expansion, is probably of use by removing them from a position in which they would interfere with the attempts of insects to reach the nectar. Similarly, the bending of the upper part of the style—also taking just before or at the opening of the flower—evidently happens for the purpose of turning both the indusium and stigma towards that part of the flower on which insects most often alight; while the few weak hairs that are found on the outside of the indusium—a point of structure that might well at first sight appear to be of little or no use in the economy of the plant—are probably of importance as serving to detain some of the pollen after it has been pushed out of the indusium in the very best position for the visits of insects that it could possibly have occupied.

To any one possessing a better knowledge of entomology than I do, it would be an interesting study to catalogue the various insects that visit this plant. In Europe this has been done for several plants by the distinguished naturalist, Herman Müller, and with very surprising results, as many as 60 different species having been observed to visit one kind of flower, while others, to all appearance equally attractive, are restricted to a much smaller number of visitors. In the case of *Selliera*, *Diptera* seem to be most frequently seen about the flowers, some twelve or thirteen distinct species having been observed, some of which, however, are of small size, and but poorly fitted for the work of transporting the pollen. Two or three *Hymen-*

optera have been noticed, including the Hive-bee. The common Red Ant is often seen crawling over the leaves, but I have not observed it to enter the flowers. I believe that several nocturnal *Lepidoptera* are constant visitors. I once saw a Butterfly sucking the nectar, while the handsome day-flying Moth, *Leptosoma annulatum*, has often been seen similarly engaged. *Coleoptera* are scarce; but one species of the *Staphylinidæ* is not uncommon about the flowers. A species of Bug is often exceedingly abundant amongst the leaves, but I have been unable to determine whether it visits the flowers or not.

It is impossible to examine the fertilization of this plant without being impressed by the fertility of contrivance, and beautiful adaptation of means to an end everywhere displayed. Passing over it in review we see first of all the open indusium, with the anthers slowly arching over and discharging their load of pollen; then the closing of the indusium, and its curious change of position, placing it in the most advantageous situation for the visits of insects; afterwards the thrusting out of the pollen by the upward growth of the stigma, and its partial detention by the hairs on the outside of the indusium; then the visits of insects, attracted by the delicate odour and the copious supply of nectar; and, lastly, their departure, but not without conveying with them, for transportation to other flowers, some portion of the fertilizing pollen. Taken singly, any one of these contrivances would appear to be of little importance, but linked together they form a chain upon the proper arrangement and entirety of which depends the very existence of the plant itself.

ART. LXXX.—*On New Zealand Coffee.* By J. C. CRAWFORD.

[*Read before the Wellington Philosophical Society, 24th February, 1877.*]

IT is desirable that we should not overlook, as regards our sources of industry and wealth, the indigenous products of the country.

The *Coprosmas* of New Zealand are allied to the Coffee plant, and I have seen it stated that coffee of fine flavour has been produced from the Karamu, *Coprosma lucida*.

I wish to call attention to another plant of the same family, viz., the Taupata, *Coprosma baueriana*. I have for some years past planted this shrub extensively in my garden, chiefly as a nurse for other trees, and as it loves the sea breeze and an exposed situation, I have found it most useful for the purpose. The question to be solved is, can the seeds of this plant be profitably utilized as a coffee, and as such enter into the products of commerce? There is much to be said in favour of the Taupata. It is extremely hardy,