III.—BOTANY.

Art. XXXIX.—*On the Pollination of* Rhabdothamnus solandri, *A. Cunn.*

By D. Petrie, M.A.

[*Read before the Auckland Institute, 7th July, 1902.*]

Rhabdothamnus, a genus of the *Gesneriaceæ*, is the only New Zealand representative of this extensive order of tropical and subtropical plants, and *R. solandri*, A. Cunn., is its only species. The Maori name is "kaikaiatua."

The plant is known to range throughout the North Island, and is fairly plentiful on the edges of the more open forests of this district. It is a slender much-branched shrub, of compact habit, and 6 ft. to 8 ft. in height. In the vicinity of Warkworth and of Whangarei it is plentiful, in both of which districts I had opportunities of studying it last November.

The flowers grow singly or in pairs in the axils of the leaves, and are produced in considerable numbers, appearing in a constant succession throughout the summer. They are borne on short slender peduncles, and stand out from the twigs sometimes in a horizontal but usually in a slightly drooping position. The corolla, which is pale-orange with red stripes, and from $\frac{1}{2}$ in. to $\frac{2}{3}$ in. in length, is distinctly conspicuous. It is irregular in form, being two-lipped, the upper lip shortly two-lobed and the lower more deeply three-lobed. The external surface is more or less pubescent-pilose, but the inside of the cup is perfectly smooth

The stamens, four in number, are inserted near the bottom of the corolla-tube. A fifth imperfect filament is sometimes present.

The two upper filaments are nearly straight, and lie directly along the upper part of the corolla-tube, while the two lower sweep downwards and outwards in a bow-like curve along the lower interior surface of the tube, bending sharply at their ends so as to nearly meet the apices of the upper pair.

The anthers cohere, even in the unopened flower, into a cruciform or somewhat horse-shoe-shaped disc. When the flower opens the anther disc lies at the mouth of the corolla, almost touching the upper border of its tube, and is so placed that the front of the pollen-sacs faces the axis of the flower. The back of the disc, formed from the confluent connectives, is smooth and polished. As soon as the flower

opens the pollen-sacs dehisce, and the fine pollen-grains, which are very numerous, are freely exposed. At this stage in the development of the flower the slender style is hardly half the length of the corolla, and ends in a blunt point.

In the course of a few days the filaments lose their rigidity and gradually shrivel. As the shrivelling proceeds the anther disc is moved across the centre of the flower, and finally rests against the middle lobe of the lower lip of the corolla. Here it remains, more or less closely appressed to the tube and retaining the spare pollen between the disc and the inner wall of the corolla. While this movement of the anther disc is in progress the style elongates, keeping close to the uppermost part of the corolla-tube. The top then bends sharply towards the axis of the flower, and expands into a rather broad rounded finely papillose stigmatic surface. When ready for pollination the style is as long as the corolla-tube, and the stigma stands a little above the centre of the flower. By this time the anther disc is appressed to the lower lip. While these changes are in progress the bottom of the corolla-tube is provided with a store of nectar that is secreted copiously and almost continuously.

Such being the structure of the flower and the order of development of its various parts, it is evident that under normal conditions it cannot be self-fertilised. The pollen is ripe and exposed long before the stigma begins to form, and the downward movement of the anther disc before the stigma is mature effectually removes the remaining pollen-grains from the neighbourhood of the ripe stigma. The process of pollination thus combines proterandry with an additional safeguard against self-fertilisation in the form of a movement withdrawing the anther disc from the neighbourhood of the spot which the mature stigma will occupy. I am not acquainted with such a combination as this in the pollination of any other native plant.

The means by which pollination is effected is at present uncertain. Though on two occasions I spent several hours of bright weather in watching for insect visitors to the flowers, I did not see an insect visit a single flower. It may be that they are visited by moths in the dusk and are thus fertilised, but the absence of scent makes this unlikely.

The fact that many of the older flowers have their corollas ruptured towards the base of the tube points rather to small birds as the agents in effecting pollination. The corolla, which is as wide as a thimble, would readily admit the beak and part of the head of a small bird. The colouring of the flower, too, is in keeping with this view, for flowers fertilised by birds are said to be usually orange and often striped with red.

I am not aware that we have in New Zealand moths large enough to rupture a corolla so large as that of *Rhabdothamnus*, for the flower is torn for fully two-thirds of its length, and not simply pricked or bitten through.

From what has been said we can easily suppose how this nicely adjusted mechanism works. Bird visitors to the newly opened flowers will have the forehead dusted with pollen from the ripe anther disc. On visiting flowers that have been open several days this pollen will come in contact with the large papillose stigma, which now occupies the position the anther disc occupied before, and thus pollination is effected.

It is likely that pollen from the same plant will be applied to a ripe stigma as often as that from another plant, for on the same shrub flowers in all stages of development may generally be found. The shrubs, however, are usually gregarious, so that true cross-pollination must often ensue. Whether pollen from a different plant is prepotent over that from other flowers on the same plant is a point that can be settled only by a series of experiments.

One or two further details are of interest. The covering of stiffish pubescent hairs that overspreads the outer surface of the corolla-tube doubtless serves to ward off small insects, such as ants, that might steal the nectar without in any way contributing to pollination.

The position of the flowers is such as would best suit the approach of small birds hovering on the wing while extracting the nectar. The twigs are so fine that they would hardly afford foothold for even the smallest native birds, or even support their weight. The rupturing of the flowers is no doubt an accidental phenomenon, caused by the bird's body falling below the level of the axis of the flower. It is certain that many flowers set seed that are never ruptured.

Art. XL.—*On the* Musci *of the Calcareous Districts of New Zealand, with Descriptions of New Species.*

By Robert Brown.

[*Read before the Philosophical Institute of Canterbury, 1st August, 1902.*]

Plates XXXV.–XL.

The following contribution towards a better knowledge of the bryology of New Zealand consists of descriptions of species collected in various places in New Zealand since the genera to which the species belong were treated of by me in papers previously read before this Institute. The greater number of the species described in this paper were collected from cal-