Art. XLIX.—*The Pipiwharauroa, or Bronze Cuckoo* (Chalcococcyx lucidus), *and an Account of its Habits.*

By Robert Fulton, M.D.

[*Read before the Otago Institute, 8th June,* 1909.]

The bronze cuckoo is probably a native of New Guinea, and annually migrates to New Zealand, passing through or near New Caledonia, the Kermadecs, Norfolk Island, and, striking the coast from the western ocean, traverses the islands, and even goes further on, appearing at the Chatham and the Macquarie Islands (1) a day or so later, thus forming an additional link in the large chain of evidence as to the original land-connection of the various islands forming what is known as the New Zealand plateau. That the birds come over the ocean from the north-west I will present evidence later on; but I would like to point out that they have been recorded at Lord Howe Island. After sojourning with us for a few months, and producing a considerable number of young ones, these summer visitors quietly return to their home in the tropics.

To the Maoris the cuckoos have been known as "the birds of Hawaiki," and even the name "pipiwharauroa" is used alike for the bronze cuckoo and for the constellation of the ark or canoe (2)—a distinct evidence that at one time it was known to the Natives to have some dim connection with those far-off lands from which their first canoes came. The meaning of the name has puzzled me, and I have several suggestions to put forward on this point. A derivation that seems possible to me is "pipirau whawharua" —*pipirau* means "some portion of the spirit-world," and *whawharua* "a mother or ancestress"—that is to say, this curious cuckoo is a bird whose mother we know nothing about, but who we think comes from some portion of the spirit-world. The word "pipi" is used for the large cockle-shell, then for the two halves separate, then for a double canoe: "the mother or ancestress who came in the double canoe." I need not multiply instances, but I hope that some of our Maori scholars will look up this point, and make quite clear whether the name came with the Maoris from some far-away islands, or whether it is a comparatively new name formed from some word or words having reference to the habits of the bird.

Another name for the bird is "whenakonako." *Whenako* is a robber, and *nako* is to dig or scratch (2). This may mean "the robber who digs his way into the earth," or merely "robber," with a repetition of the last two syllables. The Maoris were well acquainted with the bird, with its curious appearance and disappearance, its evidence of early spring-time, and its detestable habit of inflicting its young upon other birds; but it is strange that, so far as I can gather, they have not put on record any observations of its destruction of its foster-brothers or sisters, though this could hardly escape the notice of such keen students of nature. The bronze cuckoo was first described by Forster (1) in 1872, who called it *Cuculus nitens*, the glistening cuckoo, or the poupouarouro of the Natives. Gmelin (1) called it *Cuculus lucidus* in 1790; Lesson altered the name to *Chalcites lucidus*; Gray, from Dieffenbach's specimens, used the name *Chrysococcyx lucidus*,

and this name was used until the last ten years, when the present name *Chalcococcyx lucidus* was adopted by modern naturalists.

The Rev. William Yate (4), in his "Account of New Zealand," published in 1835, makes the remarkable mistake of confusing the two cuckoos, for he says, "The kohapiroa is one of the sweetest songsters of the woods, but is only heard for about four months in the height of summer. It secures itself during the winter months among stones, or in the holes in the puriri-tree, and does not leave its retreat until all danger of being overtaken with cold has passed away. The pipiwawaroa is a bird of passage, supposed to come from the islands north of New Zealand; but the Natives assure us that it retires in winter into holes in trees or crevices in the rocks, and does not fly away into winter quarters in other and warmer climes. It is a small bird of very beautiful plumage; green, white, purple, and gold are the prevailing colours. It has no song, is easily caught, and feeds upon the small insects found upon the kauri-tree."

Polack (5), who visited New Zealand, and published in 1839 his "Travels and Adventures in New Zealand," says, "Parasitic cuckoos are also found with various plumage, many of them entirely black in an atramentous covering, others variegated in green, white, and yellow; some may be seen beautifully attired in golden-green annulets mixed with black, adding a richness to the verdant green common to the birds of Java." A great deal of what Polack has written is incorrect, as was that of the Rev. William Yate, to whom I have referred. Polack says of the kohapiroa, "This little fellow is remarkable for taking particular care of itself, never leaving its retreat until the cold winds from the south have ceased to blow. It fills the bushes with melodious notes, only equalled by musical bells."

Little reliance can be placed upon the information of these two writers, who were, so far as our birds are concerned, no observers; but when we come to Dieffenbach's "Travels in New Zealand" (6) in 1843 we have the work of a true naturalist. His terse description of the birds, and Gray's classification, are all that can be desired; but he is evidently puzzled by some of Yate's inaccuracies.

The Rev. Mr. Taylor (7), in 1870, published his "Te Ika a Maui," and informs us as follows: "The piwarauroa (*Chrysococcyx lucidus*) is the other cuckoo, which is also a bird of passage. Its breast is white, the feathers being fringed with green and gold; the back is green, gold, and bronze; the feathers under the tail are white, spotted with brown. It has a very peculiar shrill note, but when first heard in August its cry is feeble. There is a saying that if it continues to cry 'kui, kui,' it will be a cold summer; but if it sings 'witi, witi, ora," it will be a warm season."

Hutton's "Catalogue of the Birds of New Zealand," (8) published in 1871, describes the whistler, or pipiuwaroa, gives careful measurements, and says, "Migratory. Leaves New Zealand in the winter, and is found in Australia, Tasmania, New Caledonia, Java, and Sumatra." Three years later Buller (9) published his first edition of his "History of the Birds of New Zealand," and evidently copied Hutton's description of the bronze cuckoo, as his wording is identical. His "Manual of the Birds of New Zealand" came out in 1882, but that and later publications threw no fresh light on the subject, and it was not until 1904, when Hutton and Drummond's "Animals of New Zealand" appeared (10), that any new details as to the economy of this bird were made available. Among many interesting points in this book is the statement that the bronze cuckoo is found in New Zealand, Norfolk Island, Cape York Peninsula; but that in this habitat it is rare. If

you turn to Campbell's "Nests and Eggs of Australian Birds" (11), published in 1900, you will find the habitat for *Chalcococcyx lucidus* extends down the east of Australia to Tasmania and New Zealand. One correspondent who lived for many years in north Taranaki, and knew the bird well, and had, in fact, for years noted the dates of its arrival, writing from Perth, Western Australia, says that "the bird was very common there in December, 1908, especially on the Darling Ranges, on the west coast" (12).

In Australia it is called the "broad-billed bronze cuckoo," to distinguish it from the "narrow-billed" (*Chalcococcyx basalis*) and the "bronze" (*C. plagosus*). Campbell (13) confines our bird to the habitat mentioned, and does not say that it is considered migratory to the tropical regions; but when he speaks of *C. plagosus*, the one most closely allied to our bird, he mentions that it is found in southern New Guinea and the adjacent islands right up to the Solomon Archipelago. The narrow-billed (*C. basalis*) has also a range right up to Timor, Java, and Malacca; so that it is extremely probable, though not yet determined, that our bird (*C. lucidus*) also comes from some place to the north of Australia, probably New Guinea. It is much more likely that the birds come from a large continent like New Guinea than from some scattered islands in the Pacific; and the fact that the bird has the Australian range before mentioned entirely disposes of the idea that New Caledonia is its wintering-place. New Caledonia may be a stopping-place, but there is no doubt in my mind that New Guinea will be found to be their home, and that the two land-bridges—one down through New Caledonia, Kermadecs, Norfolk Island, to New Zealand and the Chathams; the other down northern and eastern Australia to Tasmania—satisfactorily account for their presence in Australia and New Zealand.

It is quite possible that the Australian individuals are stragglers who have been blown a little to the west at the time of starting from New Guinea, have struck the coast of Australia, and have come straight on down Cape York Peninsula, instead of winging their way on towards New Caledonia. It is curious and most interesting that *C. plagosus*, which does not reach us here, but is very common throughout Australia, is occasionally found in New Caledonia; and the same explanation accounts for that. The birds have in that case started off a little too far to the east, have flown on as far as New Caledonia, but, having no land-bridge memory to bring them on to New Zealand, have remained there. The flight from New Guinea to New Caledonia is quite as long as anything they have ever made to Australia, and quite enough to satisfy their migratory instinct. Our own birds, however, accustomed to a much longer journey, wing their way right on to our islands, rarely even stopping at New Caledonia.

I have seen it mentioned somewhere, but cannot lay my hands on the reference, that migratory birds of the passerine order have been frequently seen to rest on the water on fine smooth days, and in this way the terrific strain of the journey may be lessened. In a recent number of the *Ibis* (14) I read of a tremendous flight of swallows and other birds clustering and resting on one of the big P. and O. liners on her way through the Red Sea. This is a most curious circumstance, seeing that there is land on both sides, and the birds had been really flying over land for some hundreds of miles. The migratory instinct, which seems to us most strange, is in the adult bird caused by the need for getting from one place where food is becoming scarce to another where the climate is warmer or more suitable for the upbringing of young, and food is more easily attainable at that time of the year. This, with the inherited memory of past flights to a suitable locality, accounts

for the action of the adult birds; but what a mystery is before our eyes when we think of the young, newly fledged birds leaving this country and starting to wing their way back to New Guinea—unguided by their parents, who have left before them—accompanied only by a number of young birds as ignorant as themselves of the locality of the winter home in the tropics! Still more mysterious is this when we read of a young cuckoo, kept in a state of captivity, and prevented from migrating at the proper season, entranced, as it were, in an instinct of migrating, keeping up for hours an apparent flight over a trackless ocean.

Benjamin Kidd (15) says of the English cuckoo, "Some years ago I had the good fortune to rear from the beginning a specimen of the young of the common cuckoo. As my young cuckoo became full grown it was gradually attuned by nature for its wonderful migratory flight. The cuckoo travels in its annual migrations enormous distances over land and sea, sometimes from the extreme north of Europe across the Equator into the Southern Hemisphere. In this case there is no room for thinking that the young birds find their way as the result of any teaching from the older birds of the kind, for these leave many weeks later than the older birds, and so travel apart. As the season waned, and the time for the migration of my young cuckoo approached and passed, its behaviour grew interesting. The bird always became very restless in the evening. Being much attached to me, it generally settled at last, so as to be near me, on the stationery-case on the table on which I was writing, in the dim light thrown by the upper surface of the green shade of the reading-lamp by which I worked. Here, as the hours wore on, the same thing happened every night. After a short interval the muscles of the wings began to quiver, this action being to all appearance involuntary. The movement gradually increased, the bird otherwise remaining quite still, until it grew to a noiseless but rapid fanning motion of the kind that one sees in a moth when drying its wings on emerging from the chrysalis. This movement tended to grow both in degree and intensity, and it generally lasted as long as I sat up during the night. In the early stages of this mood the bird responded when I spoke to it, but in time it ceased to do so, and became lost in a kind of trance, with eyes open and wings ceaselessly moving. Brain, muscles, nervous system, and will all seemed to be inhibited by the stimulus that excited it. The bird became, as it were, locked in the passion of that sense by which the movement of flying was thus stimulated. It was one of the strangest sights I had ever witnessed—this young migratory creature of the air, which had never been out of my house, and which had never known any of its kind, sitting beside me in the gloom of our northern winter and in the dim lamplight, by a kind of inherited imagination, yet which was not imagination in our sense, flying thus through the night league-long over lands and oceans it had never seen." It would be of extreme interest if some of our naturalists would capture and retain some of our young cuckoos of each species and endeavour to determine whether the same thing would occur here.

Richard Kearton (16), the well-known writer on birds and their nests, says, "The speed and endurance of some species is remarkable. It is asserted that both the common swift and the Virginian plover can travel well over two hundred miles an hour, and the former bird is on its untiring wings sixteen hours a day. The performances of our "ocean greyhounds," which have an unlimited amount of coal and water, are paltry in the extreme when compared with those of a bird which could easily fly from

London to New York during the light of a single day, on a mere thimbleful of gnats, or one that can take its breakfast in Canada and its supper in Brazil. Sustained powers of flight are chiefly useful to the majority of birds during their migratory journeys. On these occasions they perform some astonishing feats, principally during the night-time, when I have heard different species calling to each other as they passed over London. The migratory movements of birds are in many respects very curious indeed: all breeding movements are in the direction of the Poles and away from the Equator. These great spring and autumn movements take place over certain well-established tracks or "fly-lines," and the mystery of mysteries is that during the autumn journey the birds that know nothing about the fly-lines from actual experience go first. Out of three hundred and sixty different kinds making the Island of Heligoland their stopping-place for a rest, in only one single instance do the old birds precede the young ones, and that is the case of the cuckoo. Migrants from Europe spend the winter in Africa as a rule, and it is said that those breeding farthest north in the summer fly farthest south in the winter, and that British swallows and martins reach Natal and Cape Colony."

Chalcococcyx lucidus has a number of popular names—the bronze-winged, shining, glistening, bronze, golden-winged, green, short-tailed, and smaller cuckoo; cuckoo's mate and dog-whistler, or simply whistler, are also common terms based on its curious cry. The bronze cuckoo may be said to be one of the most notable of the New Zealand birds, and to have a real historical and geographical value, for it was by observing the habits of the bird that naturalists found that New Zealand participated in the great southern migrations. When Mr. Colenso (17) stated in 1842 that this bird was migratory, the furthest distance across the sea that migratory birds had been known to fly was from Norway to Scotland, and across the eastern Mediterranean Sea from Egypt to the Greek Islands—in each case a distance of about three hundred miles, involving about eleven hours' continuous flying. When it was asserted that the shining cuckoo traversed more than three times that distance of ocean—from New Caledonia to New Zealand and the Chatham Islands—it was thought that naturalists here had made a mistake. A. R. Wallace, in his "Geographical Distribution of Animals," as late as 1876 says, "This is extremely improbable, especially in a country which has still such wide tracts of unsettled land. It is very possible that the birds in question may only move from one part of the islands to the other." Hutton and Drummond add, "It is now fully acknowledged, however, that those birds do migrate, and that they are among the most notable migratory birds in the world."

Early in spring, usually about the last week in September, residents of New Zealand from end to end are familiar with the beautifully sustained notes "kui, kui, kui" of our bronze visitor. For a week or two the "whiti whiti, ora," or the final flourish or trill of "tiu, tiu, tiu," is not heard; and, just as in England the first notes of the common cuckoo are not what they are a few weeks later, so in New Zealand and Australia (18) the first arrivals, the males, are either silent or their song or call is decidedly shorter and more limited than when the breeding season is in full swing and their notes of courtship are more entrancing. Bearing on this question of the shortness of song of the first arrivals, the male birds, no doubt, as is well known of migratory birds, having the lead on account of strength of wing, Mr. Campbell says of the pallid cuckoo, "They are first heard about the end of August or beginning of September, but so far as my observations

go these are preceded by silent birds of the same species, which may be seen about the timber, or perched on fences or telegraph wires, about the first week in August. Why these forerunners should be silent, or whether they are all of one sex, has not been ascertained." A number of our New Zealand correspondents confirm this limitation of the call of our bird in the first few weeks of its arrival.

In good and warm seasons the birds probably come a little earlier, and the females arrive on a correspondingly early date. This, of course, accounts for the early production of the full note or song, "kui, kui, kui, whiti, whiti, ora," in a good and possibly apparently mild season, a point in the economy of the bird which the Maori was quick to notice (19).

Herr Gatke (20), one of the greatest authorities on migration of birds, says that the forerunners of the spring migration in the Northern Hemisphere are invariably old males; next come the adult females; then younger males and females; and finally males and females of the previous year. Supposing these cuckoos all start at about the same time, the strongest birds would obtain a lead by the stream of birds tailing out on a journey of this length, and the males, on arrival, would be comparatively quiet until the arrival of the females. There is no doubt that the birds take advantage of favourable winds, and wait till a favourable wind blows, or their instinct may have been adapted in the course of ages to the exact period of the year on which a particular wind blows. The gales of certain directions in the Southern Pacific are all fairly punctual, so to speak, and are generally on hand when expected. The birds come down from the north-west, and strike the coast-line of New Zealand in great numbers, for evidence is forthcoming that they are heard almost as early in the south of Otago as in the north of Auckland, and the dates on which they are stated as being seen and heard throughout the islands do not connect or coincide in a manner sufficient to prove to us that the birds reach the far north first and gradually work south, though this is, of course, possible. When we know that these birds must easily cover five hundred miles a day, it is not of much consequence to know what day in September or October they arrive at any one particular part of the Dominion. They have been heard as early as the 7th September in north Taranaki, and at Tongaporutu, forty miles north of New Plymouth, on the 28th September. They have been heard as early as the 15th September in Otago, and for many years I noted their arrival at West Taieri from the 20th to the 23rd. Reports come from many other places during the same week, and they keep on arriving and being reported as late as the end of October or even into November. In quite a number of instances the lighthouse-keepers, to whom I specially appealed four or five years ago, have reported the arrival of the birds, noting barometer and thermometer and direction of the wind at the time, and almost invariably the wind is strong from the north-west. Mr. Anderson, at Kahurangi Point Lighthouse, which is half-way between Westport and Cape Farewell, says, "One arrived on the 6th October; on the 13th I saw three."

The birds are reported to have been seen in great numbers at Totara, an old Maori battlefield two miles south of Shortland, Thames. Mr. Noel Buchanan reports it at Collingwood on the 25th September; Mr. Elsdon Best at Ruatoki on the 2nd October; Mr. Puckey at Kaitaia on the 6th October; and Mr. McCulloch at Hastings on the 12th October.

Mr. Arnold, from the East Cape Lighthouse, says, "On the night of the 5th November one bronze cuckoo struck and killed itself against the lantern-

panes of the lighthouse"; and during the next day he noticed one flying about the island. It allowed him to get within a few yards of it, so he supposed it was pretty well exhausted. The wind for the previous week had been from the westward, blowing strong. This bird had come on, and almost overshot the island during the night by mistake, or possibly was one of those which had previously migrated to the extreme eastern portion of the New Zealand plateau—namely, the Chatham Islands—for which it was directly heading.

These references make it fairly clear that the birds arrive in considerable numbers by a north-west or westerly wind about the latter end of September, and, striking the coast, spread all over the Dominion and on to the outlying islands in a few days, or even possibly hours. They keep on arriving for several weeks, and, though often seen, are not heard for some days after their advent. On the outlying parts of the coast they are seen in greater numbers, as these are principal ports of arrival from which the birds spread out over the country.

The birds soon begin their beautiful call of "kui, kui," generally at night at first, and whether the full song is uttered by the male bird or female, or both, has not yet been determined. It is possible that the incomplete song is that of the male, and the beautiful twittering call with the flourish at the end the female's. This interesting point can only be cleared up by getting specimens of these birds during their call.

It is quite certain that, whether due to losses on the voyage or for some other reason not yet understood, the females are always in a considerable minority, and that the bronze cuckoo, like parasitic cuckoos and cowbirds elsewhere, is polyandrous, and the ventriloquistic whistle which is characteristic of birds of similar habits all the world over is part of the complicated scheme of parasitism (22). Those who are interested in this question will also find it fully set out and explained in my papers on the long-tailed cuckoo (21).

With regard to the whistle, I have been standing under a manuka-bush, and have heard the bronze cuckoo whistling "kui, kui, kui," and have located it to my satisfaction to be calling from the top of a white-pine 50 to 100 yards away, and, say, 100 ft. up in the air; then I have changed my opinion when the second silvery bar began and progressed; then another set of notes, and I have decided that the bird was in a big broadleaf-tree, say 50 ft. or more away; then a fresh set of "kui," and I have begun to wonder if the bird was not in the very bush under which I was standing; and finally, with the notes welling out into a piercing call, I have found it within 5 ft. or 6 ft. of my head, shaking and twittering, with its quivering wings half-spread, expressive, as Buller says, "of a state of highest ecstacy." Now when I hear a cuckoo calling I stand perfectly still and search the closest boughs with extreme care, and then I can generally see the bird calling quietly and softly, and can almost detect the extra power and force it puts into its notes by its gradually increasing movement, and I might almost say increasing chest-expansion. The bird seems actually to swell itself out much in the way the tui does when he is showing off for the benefit of his white-throated consort. This cuckoo's call is one of the most perfect examples of ventriloquism, and the harsh cry of the koekoea is thrown out in the same extraordinary manner.

Touching on the question of polyandry, one correspondent says, "On the 13th October I saw three in a young rata-tree; one was sitting with its wings spread, the other two were chasing each other through the branches."

This was undoubtedly a female bird with two male birds. Exactly the same description almost to a word is recorded elsewhere, and has been frequently given to me about the long-tailed cuckoo. "On one occasion I saw about five or six; they seemed to be fighting, for they flew close past me. As it was the early season, they were probably males fighting for a mate." [*Otago Witness.*]

There is another point with regard to the call that must be noted, and that is the extraordinary effect it has upon the other birds in the neighbourhood. As soon as the call begins anywhere near a spot where sparrows and linnets abound, a chattering and screaming at once is set up, and all the birds in the vicinity congregate and hunt the intruder. The tomtit and fantail seem to be very much afraid of the cuckoo, and usually retire hastily on hearing its cry. A bronze cuckoo has been seen to go into a willow-tree in which was a nest of the grey warbler, and the two little birds stayed close to the nest absolutely still, as if paralysed with fear, or fascinated. The cuckoo flitted about a little, and then flew away, without molesting them or their nest.

Sometimes the pipiwharauroa is seen on the topmost branch of a high tree, and when it gives forth its note it is at once hunted from its perch by tuis and mockers. If it flies away and alights on the highest limb of some other high tree—generally a leafless limb—it is again hunted off by the tui. Mr. Mahoney, Native teacher at Hiruharama, Waiapu County, Hawke's Bay, says he has heard the bird call, and on running to the window has seen it fly away, leaving the sparrows, minahs, yellow-hammers, and thrushes discussing his sudden appearance in very excited and indignant tones.

The kingfisher is an enemy, and has been seen chasing the cuckoo from tree to tree. It may be taken for granted that this hostility is due as much to the bird's thieving propensities as to its habit of entrusting the hatching of its progeny in many instances to other birds. The long-tailed cuckoo (22) was similarly charged, and most ornithologists discredited the idea of its predatory habits, and said that the hostility of other birds was due to the fear of having their nests burdened with a parasite which would soon destroy the rightful tenants. Sir Alfred Newton and many others considered the accounts of cuckoos being found with eggs in heir bills was no proof of stealing—that the whole story was a vulgar error, and that in all cases the egg was that of the cuckoo herself. Those of you who have read my papers on the long-tailed cuckoo know how I disproved that theory, and showed what the bird does in the way of egg and chick stealing in New Zealand (23). Similarly, the few instances I give you about the bronze cuckoo show that it also takes eggs from little birds' nests, but it is not likely that it takes chicks, as its size and structure are not suitable for tearing up little birds, as does the koekoea, nor is its throat large enough to swallow unfledged chicks whole, as that rapacious creature does.

One correspondent whose letter I have mislaid saw a bronze cuckoo in the garden with a blue egg in its claw, and it was pecking at it and eating it. Basil Henning, of Akaroa, gives a thoroughly clear account of the same thing. He says, "I wanted a bronze cuckoo for my collection, and, while waiting hidden, the bird came down to the brown wren's nest, in which were four eggs. It entered the nest and flew off with one egg. When I killed the bird the egg was broken. I am certain the bird intended to eat the egg, and the egg taken out was the brown wren's—*i.e.*, brown creeper—and exactly the same as the other eggs in the nest." These two instances,

with the evidence of what we know of other cuckoos, make it certain that *Chalcococcyx lucidus* is predatory. Mr. Potts (24) says, "The whistler is a great insect-eater, and appears specially fond of the well-known ladybird. We are not without certain suspicions that it devours or destroys the eggs of other birds."

Now, as to the other reason for the hatred of the birds generally—the habit of coolly dropping its eggs into other birds' nests—of this the evidence is overwhelming, though no one has as yet seen the act of deposition. The riroriro (*Pseudo-gerygone*) has been known to actually hatch out this bird from an egg which has been dropped into its little bag-like nest; and the monster thus hatched in many instances heaves out the occupants, or lies on top of them, so as to obtain possession of all food and thus starve them. I have myself found young warblers alive on the ground beneath the nest containing a young bronze cuckoo; I have replaced the young warblers, and found them dead on the ground next day. I also remember as a very small boy being told that one of my brothers, now deceased, had actually seen the process of expulsion going on, but I was too young to take any interest in it. Now, why is the grey warbler the bird that is most frequently selected as a host for this egg—the only bird in our country which builds a domed or covered-in nest? Many of you know Wallace's description (25) of the feeding-area and the breeding-area of migratory birds. Now, in some birds the summer breeding-area and the winter feeding-areas coincide—the nature of the country is satisfactory, and the supply of food is available all the year round; in others the two areas are separated by more or less wide intervals. New Zealand is the breeding-area, New Guinea probably the feeding-area, of this cuckoo, and the construction of the nest of the riro-riro leaves no doubt that it, too, in the remote past, came to this end of the great continent to breed, still building its pendant nest, so difficult of access to the various enemies—snakes, &c.—which it had to face in its tropical feeding-area. In all tropical climates there are numbers of birds which build pensile nests, adequately protecting their young, and it is significant that the only other one of our birds which has a nest approaching in any degree a pensile nature is the white-eye or *Zosterops* of tropical Australia. The cuckoo chooses the nest of the warbler—first, because it is a bird that almost certainly at one time had the same breeding and feeding areas; second, because the young hatched in such a pensile nest have more chance of reaching maturity than when hatched elsewhere—eggs deposited in such a nest are in comparative darkness, and are less likely to be disturbed, thrown out, or deserted. Chicks reared in such a warm, comfortable home have a great advantage over birds growing in open, uncovered nests. The proof of these points can be seen in the preservation of the riroriro when so many of our other little birds have almost disappeared. Sir Walter Buller (26) gives an account of the warbler hatching out a young cuckoo, and has a plate of the cuckoo in a warbler's nest; and Potts (24) mentions sixteen instances of cuckoos' eggs taken from the nest of the warbler.

A correspondent had this season a cuckoo's egg and several eggs of the warbler sent him through Magister's kind offices. These had been most unfortunately removed from the nest instead of being watched for further developments. There is no doubt that a number of young cuckoos of either species are fed by other birds, and particularly by the grey warblers, which have not necessarily hatched them at all, but which, finding them piping in distress, take pity on and feed the orphans. This is quite commonly observed in Australia (22). Little birds which are never known to hatch

out cuckoos have been seen to feed young ones; not only so, but different species of birds have been seen to come to the same cuckoo and feed it one after the other. "During the months of October and November it is no uncommon sight to see the smaller Australian birds feeding the young cuckoos. Even the little *Acanthizæ*, which are seldom if ever the foster-parents of the pallid cuckoo, join in supplying the wants, which are made known by a peculiar peevish cry. It stops only while feeding is going on, or when the appetite is fully appeased." So the New Zealand birds the makomako, the tui, the warbler, the tomtit, robin, brown creeper, canary, the wood-pigeon, and the white-eye are all known to feed the cuckoo bantlings, not because they are purely duped, but very often from a true philornithic spirit. It is fairly certain that in those cases where the warblers have been seen to feed more than one cuckoo at a time the warbler was a foster-feeder only, and not a foster-parent.

"On February the 11th my son drew my attention to two young shining cuckoos sitting on a branch of a nut-tree being fed by two wrens (probably grey warblers). It was most interesting to see how assiduously they searched for insects for them, and popped them into the big birds' mouths almost quicker than your eye could take stock of the action. After about an hour one wren went away, and, so far as we can discover, never came back again, the feeding then devolving on the other bird; and as the day wore on she was bullied most unmercifully by the two cuckoos, who kept up a constant twittering, and chased her from tree to tree, pecking her if she did not bring them food quick enough. She soon had a dishevelled appearance from her exertions, and could be seen at odd moments trying to preen into order her dishevelled feathers, when down would swoop one or other of the cuckoos and peck at her till she hurriedly hopped or flittered from twig to twig, and, returning with lightning-like quickness, popped a minute insect into its open mouth. My family watched them being fed thus by one wren all that and the next two days, and they have been heard but not observed closely to-day. I thought this case was worth recording, as I was of opinion the cuckoo only laid one egg in each nest. It seems almost an impossibility for two such large birds to hatch out of so small a nest." No case has ever been recorded of two cuckoos of the same age coming to maturity in an adopted home; many cases, however, have been known in which two cuckoos' eggs have been hatched, deposited certainly by two different cuckoos. In such a case a continual struggle goes on for the first few days, ceasing only when the stronger or more adroit succeeds in hurling to destruction its companion. Similarly, when warblers with their own chicks have been seen feeding young cuckoos, they are not the foster-parents, but only foster-feeders.

The young birds are singularly helpless or lazy, as the following instance shows: "I first became acquainted with this bird in 1888. I was roaming about in the bush, and heard it piping as in distress, and discovered him being fed by little warblers. Later on I found some in a paddock of clover infested with caterpillars; the caterpillars were crawling over their feet, and yet they cried to the small birds to feed them, and so save themselves the labour."

A number of other birds are imposed upon—fantails (26), robins, tomtits, blackbirds (28), and sparrows (29), as eggs have been found in their nests. As is the case with cuckoos elsewhere, the egg varies considerably, according to the host imposed upon. The commonly accepted description of it is olive-green (29), but white eggs and blue eggs of a curious elongated

shape have been found, which, there is no doubt in my mind, belong to this bird. One gentleman says, "Last year while clearing bush I accidentally cut down a tree containing the nest of a riroriro. On examination I found snugly stowed among the feathers with which the nest was profusely lined, three eggs. Two of these were roundish, plump little eggs of a dull-white ground with brown spots; the other a long, narrow, blue egg, not bulging in the middle, but gradually tapering from end to end, as if intended to be carried in the beak of the cuckoo, and so placed in the nest. Of course, I could not say they actually do this, but it is the only way to account for its presence in the nest, the aperture being far too small to admit either of the New Zealand cuckoos without destroying the whole fabric."

I need not go into the question of the variability of cuckoos' eggs: it is well known, and has been discussed for the last fifty years. I need only say that particular birds have selected particular hosts for generations, and the eggs in these cases have gradually become approximated in size, coloration, and spotting to the eggs of the nest-owner. How the egg of the shining cuckoo is placed in the nest of the warbler is as yet unknown; the cuckoo almost certainly lays the egg on the ground and then places it in the nest with its beak.

Mr. Jesse (31) refers to the fact that he has found the egg of the cuckoo in a nest where it is impossible for the bird to have deposited it other than by its bill. The fact of the cuckoo carrying her egg in her bill is now generally admitted (32). In Tasmania (33) a fresh egg of the fantail cuckoo was found deposited on a bare stump. Doubtless it had been laid there by the bird, which was probably disturbed before it could convey it away to some suitable nest.

There have been a few fortunate observers who have actually seen the deposition of the egg upon the ground by the cuckoo, who then, taking it in her bill, introduces it into the nest (34). The most positive evidence on this point is that of Adolph Muller, a forester at Gladenbach, in Darmstadt, who says that through a telescope he watched a cuckoo as she laid her egg on a bank, and then conveyed the egg in her bill to a wagtail's nest.

Having deposited the eggs in various nests, the adult cuckoos roam about in little flocks of five or six males to one female. They feed on flies, moths, ladybirds, and other insects, until their young ones are able to fly, keeping an eye on them, occasionally feeding them, and getting ready to shepherd them until the time for the return migration. This is quite commonly known and recorded, and I have referred fully to it in connection with the long-tailed cuckoo. Allan Hume (35) says, "I have never seen crows feeding fully fledged koels out of the nest, but I have repeatedly watched adult koels feeding young ones of their own species. I am pretty nearly convinced that after laying their eggs the females keep somewhere about the locality, and take charge of the young directly they can leave the nest; but I never saw more than one young one in the charge of an old female." Another correspondent says, "I once saw a young cuckoo which was being fed by two little grey warblers. Then I noticed another cuckoo on a branch not far off, and after a little while the little birds fed him also. They remained in the same bush all day, and did not mind when you came quite close up to them; they kept on feeding them till it was getting dark, and next morning I found them again in the same hedge. About 9 o'clock there appeared, to my surprise, a third cuckoo. It was bigger than the others, and seemed very wild. This one could feed itself already, because I noticed it picking things, probably leeches, from the leaves; but it still

wanted to be fed by its foster-parents. I counted five warblers, one on the hedge and four feeding the three cuckoos. On the third morning they were still on the hedge, but about 10 o'clock they disappeared among the trees. When birdnesting I have found sparrows' nests with strange eggs in them, which I took to belong to the cuckoo."

A correspondent from Rotherham says, "We have had two shining cuckoos visiting our garden every day for the last week. The birds are, one a well-grown young bird, the other an old bird. Their favourite haunt is a pear-tree that has suffered rather much from the pear-slug, which they seem to enjoy. In the early morning the birds are to be seen among the fruit trees. The young one is very tame. I could have caught it with a butterfly-net on more than one occasion. I never knew an old bird to stay so late as this (21st February), even in Taranaki."

Another correspondent says, "I have often seen a pair of warblers feeding a young cuckoo in addition to their own offspring. I do not think the cuckoo throws the young warblers out of the nest, for I have often seen the parent warblers feeding one cuckoo—never more than one—and two young warblers. The parent cuckoos do not seem to eat much during their stay here—I have never seen them eat anything but an occasional butterfly."

A writer from North Taieri tells me that he saw some young cuckoos about the 1st February on a kowhai-tree. The down feathers were still there, though only a few to be seen. The plumage was nearly full, the green not showing, the copper predominating. Towards the middle of the month they had the first part of the adult cuckoo's notes, such as the adult has in the early part of the season. Some years ago he saw one or two very young birds being fed by warblers, but in this case he saw no foster-parents near them. They seemed to be able to get their own supplies. The green of the kowhai harmonized with their colour.

From Mr. W. W. Smith's (36) account of the hatching of the young bronze cuckoo it is evident that the egg which has been deposited in the nest of the fantail, robin, or warbler takes about ten or twelve days to hatch out, and very soon a tragedy indeed is witnessed. How strange that while we have discussed the altruistic spirit in which many little birds instinctively feed these peevish little orphans—frequently to the detriment or, at any rate, discomfort or partial neglect of their own offspring—yet here we have to face the fact that these very chicks have deliberately done to death scores of individuals which had as much, if not more, right to live than themselves. The young bird, within forty-eight hours of being hatched, blind and almost helpless, fitted by nature with a peculiar hollow between its shoulders (37), spreads its legs, fixes them firmly in the bottom of the nest, wriggles first its head and then its back under one of its companions, balances it, and grips it firmly between its shoulders, and gradually heaves up, one by one, and pushes out through the opening of the nest, its unfortunate foster brothers and sisters.

In about ten days the young bird is fully fledged, and fat, having obtained as much, if not more, food than a brood of four or five warblers would have consumed. It bulges the nest to bursting-point, and probably tears it to pieces in its efforts to get out. I can find no evidence on this point, even about any of the Australian species, and the only descriptions recorded in detail of our birds by the Rev. Mr. Taylor and Mr. W. W. Smith (36) contain the bald statement only, "quitted the nest." I wish some of our Australian ornithologists would refer to the young of the fantail cuckoo, and give us details of their upbringing in the tiny little nest of the *Acanthizæ*.

Do many of these cuckoos perish by these little nests being carried away by the weight of the cuckoo before it can fly? How soon do they leave the nest? And have any instances occurred of the actual discovery of the young cuckoo in one of these nests? The eggs are deposited therein, but are they hatched; and, if so, what is the result? Does the cuckoo throw out its mates? How does it get out of the nest, and when? How long can the nest support its weight?

The movements of the adult cuckoo are quick; it sometimes twists and turns in a tree like a flash. At other times I have seen it sitting very quiet and perfectly still for a considerable time. The male bird usually selects the topmost spray of the tallest trees for its perch during the time it is giving utterance to its remarkable call. He seldom remains long in one spot, and indulges in a restless jerky motion of his tail. "In selecting the nest of so early a breeder as the grey warbler as a home for its young it secures certain advantages for the benefit of its offspring which should not be lost sight of (38). At the period of the cuckoo's arrival the warbler has most probably reared its first brood. Everywhere insect life abounds, so that a proper supply of food sufficient for so comparatively large a bird can be obtained by its little foster-parents with less labour and more certainty than could have been secured two months earlier, when several birds commenced their breeding arrangement."

The trees that the cuckoos are most fond of are the young kowhais, the beautiful light-green feathery leaves forming an effectual concealment for a bird whose plumage is closely approximated in colour. Besides this, the large moth called the kowhai-moth abounds thereon, with many other insects of worth. Another tree cuckoos are fond of is the ngaio, also affected by grey warblers and white-eyes.

The birds consume an enormous amount of flies, gnats, fruit-slugs, moths, and butterflies; the capacity of the young is tremendous, and the number of trips made by a warbler or fantail in feeding one of these birds is incredible. An adult bird has been seen to chase a trout-fly at the end of a fisherman's line.

A young bird was sent to me which had been found dead among a number of sparrows and linnets which had been killed with poisoned grain; but Dr. Benham, who examined its crop for me, found no grain, but a great number of moths, daddy-long-legs, and caterpillars. The bird must, however, have taken some morsel of poisoned food, sufficient to kill it.

The young bird, even fully fledged, has its head, wings, and back a coppery-red colour: this changes in the adult to the well-known bronzy green.

The cuckoos, having continued to lay eggs and to deposit them right up to the end of January, begin in February to prepare for their return migration. By this time they have moulted, and are freshly equipped with plumage. They have been supplementing their insect food, which they find in abundance on our fruit trees, by acquiring a fondness for fruit. Seeing mockers and white-eyes taking fruit, and perhaps themselves pecking at flies or caterpillars on the fruit and obtaining an astonishing supply of some new sweet substance, they are now becoming fruit-eaters like many other of our insect-feeders. Buller (39) scouted my report of a wood-pigeon feeding a young koekoea, as he said a pigeon, being berry-feeding, would know nothing of the insect-feeding necessary for the cuckoo. Yet here we have an instance of the beginning of a complete change of habit, due to change of environment. It is probable that the bird will soon become accustomed

to berry-feeding, and, finding sustenance more easily obtainable, fail in many cases to migrate in autumn. That this does happen is well known; a number of instances of cuckoos wintering here (40) are recorded.

A correspondent from Waihi tells us that the birds have been a nuisance in his orchard. Writing on the 9th February he says, "I watched two shining cuckoos—the first pair I have observed here this summer—attacking a Burbank plum-tree to-night; they were literally gorged. I do not know whether this penchant for fruit is extraordinary, but I send you the facts."

At the end of February most of the old birds have gone north so far as New Zealand is concerned, but a gentleman from Taranaki who knows the birds intimately reports from Hobart, Tasmania, "The pipiwharauroa was very plentiful here during the week ending the 16th February, and its joyous note could be heard in every gully. On the 16th, however, we had a very cold snap, with frost, and since then the bird seems to have disappeared entirely. It would be interesting to know if any of your readers have observed anything of the sort in New Zealand."

Several authorities (38) say the cuckoo is a very shy bird, and I have always found it so, but the Maoris say it is easily caught (41). One correspondent says, "The golden-backed cuckoo comes here for a short visit every spring, and always sits and calls in a tall gum-tree between the house and the sheds. After a day or two the birds get bolder, and may be seen within 2 ft. or 3 ft. of my face on any little fruit tree close to the verandah. It also loves a peach-tree which reaches a few feet above the top of the window; and one day, after searching the tree for any grubs, it boldly flitted into the room and perched on the furniture quite fearlessly. I closed the window, and easily caught it. Not knowing what it was, I plucked one marked feather, and reopened the window; it flew off my hand, and continued its search for food, quite unalarmed. It seemed to catch the flies about the room. I have not noticed more than one at a time, but it always comes each year."

The lighthouse-keeper at Kahurangi says they generally leave in March, but he saw two young birds there in April, 1908. Mr. D. Quinn, from Dog Island, says he has seen them at Otakou until the beginning of April.

There is no evidence as to a gradual return along the islands, though this is possible. Buller (42) says they leave in January, but Captain Hutton (43) makes it clear that young ones are often seen in April. He says, "All the old birds leave the south during the first and second weeks in January, but they do not leave the north until the end of January. Some at least of the young birds leave considerably later than their parents, as they have been shot in the South Island in April. Their times of appearance and departure are wonderfully regular in both Islands and the Chatham Islands. Outside New Zealand there is little information."

The bird breeds in Norfolk Island. Mr. Bell tells me that it is seen, though very rarely, at the Kermadecs, and it is probable that its winter home is in New Guinea. I have written to New Caledonia and New Guinea, and hope next year to have something authentic on this point.

Before leaving this interesting subject, I should like to state that all cuckoos were originally nest-builders, and that the habit of parasitism has been slowly acquired. I have gone very fully into this subject elsewhere, and have given the various theories advanced for the adoption of this strange habit (44). Some of the American cuckoos are non-parasitic, but are gradually acquiring parasitism. Cowbirds show all stages of the habit, from ordinary nest-building to true parasitism. Our long-tailed cuckoo

inflicts her eggs on many birds, and the chicks are fed by the foster-parents and other kind-hearted birds, notably the warbler, which does not hatch the eggs. Now, when we have a habit such as this, which has been acquired, and which is quite different from the original custom of the birds, we expect occasionally to have what is know as atavism cropping up—that is, a reversion to the original instinct of nest-building. This is exactly what we do find with cuckoos in different parts of the world.

An instance has been recorded (45) of the great spotted cuckoo of Europe having built a nest and hatched its young, though the statement was at the time discredited by ornithologists. The true Indian cuckoos are strictly parasitic, and *Hierococcyx sparveroides* is considered by most observers to be universally so. The Indian cuckoos are seldom seen in pairs, generally singly or in small parties; but this particular species is said by Allan Hume (46) to be more often seen in pairs than any of the others. That this is an evidence of a leaning towards domesticity we find in the interesting fact that Mr. R. H. Morgan, of the Madras Forestry Department, avers that on one occasion he watched this species actually build its own nest, and that he then removed the eggs, of which four were laid.

It is reported of the Kermadec Islands (47) that a reliable observer there has seen old long-tailed cuckoos feeding their young, and he considers that they build their own nest and bring up their young themselves. There is no doubt in my mind that in those cases where a pair of cuckoos are seen together with a number of young ones, the cuckoos have hatched out their brood. There is a strong impression in my mind that the group of fully fledged young birds seen by themselves at North Taieri, able to feed themselves, and having no foster-parents near them, were a brood that had been hatched out together and brought up by their own parents.

In addition to this, cuckoos very often feed young birds. Mr. Ivy (48) gives several instances of African cuckoos lurking about nests, and he saw two adult birds (*Coccystes glandarius*) with five young ones all flying together. This may have been a pair which had mated, built a nest, and hatched out their young; but Mr. Ivy was of the opinion that the old birds had merely collected their brood previous to migrating.

A gentleman from Nelson, well known to myself to be a thoroughly reliable observer, has sent me the following interesting letter, dated the 25th September, 1908: "I have had exceptional opportunities of becoming acquainted with the habits of our native birds, extending over a period of nearly fifty years. Last summer I was prospecting on the Wautui River a week or two before Christmas, and I noticed a pair of these bronze cuckoos close to the camp. I watched them carefully, and they seemed to spend all their time catching flies over a still pool in the river, and continually flying into the bush in one direction. My mate and I spent considerable time day after day trying to find the nest, but could not do so. At last, one morning about daylight, we saw seven of them all round the same pool—five of them were obviously very young, as they could only fly a very short distance at a time. The five young ones would sit on a branch, often the same branch, side by side, and would not change from the position for quite a long time, the old birds continually feeding them, but never the same one twice in succession. This went on for about two or three weeks, every day the youngsters becoming more like the old birds, and taking longer flights. At last, about a month from the time we first saw them, they disappeared, and we never saw them again. Some days after they left I quite accidentally found what I feel certain was their nest. It was in a dry cabbage-tree,

under a leaning dead stump about 6 ft. from the ground, and concealed by leaves and rubbish. In and about the nest we found feathers that I am sure once belonged to the old birds. In this instance the whole thing was so clear that it left no doubt in my mind as to their mode of rearing their young." This is a very circumstantial account of the reversion to the habit of nest-building in this pair of birds. The lack of pairing in the ordinary sense of the word leads to parasitism. The action of these two birds in pairing, constructing a nest, or at any rate making a place where eggs could be laid and hatched, feeding systematically, and afterwards teaching five young ones to fly, constitutes one of the most interesting facts in the economy of that generally considered parasitic bird the bronze cuckoo of New Zealand.

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Art. L.—*The Remarkable Rainfall and Meteorology of Waihi.*

By H. B. Devereux, F.R.Met.Soc.

[*Read before the Auckland Institute, 22nd November*, 1909.]

Before entering into the subject-matter of this paper it will be necessary to refer to the peculiar topographical features of the Waihi district.

Waihi, which is situated on a more or less circular basin, about five miles in diameter, and averaging about 350 ft. above sea-level, lies at the western end of the Bay of Plenty. It is flanked seawards by the high abruptly rising coastal range, and to the west-south-west by the Cape Colville Range, which has its highest point in Te Aroha Mountain. Irregular ridges bound the basin to the south-east, and on the north-west a moderately high range, of irregular features, completes an apparent circle. Several isolated hills of moderate height, mostly described as " barren clay hills," and bearing evidences of the denuding effect of strong westerly winds and heavy rainfall, rise from the plain.

In a meteorological sense, the most notable feature of Waihi is not so much the frequency as the intensity of its rainfall. It will be the endeavour of the writer to throw some light on the agencies which bring about such remarkable records.

First in importance are those cyclones which come—(1) from the neighbourhood of Norfolk Island, and, passing eastward of North Cape, pass to the northward of East Cape ; (2) approaching East Cape from about north, but passing eastward of it, and when southward of it take a more south-east direction. As a rule, the track of these systems is well to seaward, but sufficiently close to cause very heavy rainfalls. Occasionally the track is across the Island, between Taupo and East Cape : this movement is accompanied by heavy easterly gales, severe backing winds, and intense rainfall. This forward movement across the island, however, is the exception, for the physical features of the land seem to have the power of deflecting these storms to seaward. The passage of a cyclone to the east is, as a rule, not accompanied by heavy southerly backing winds, for Waihi is well sheltered in this respect by the high country to the south and south-east.

Again, a common feature of the meteorology of this locality is the junction of a westerly wave depression with a cyclone, with the usual effect