



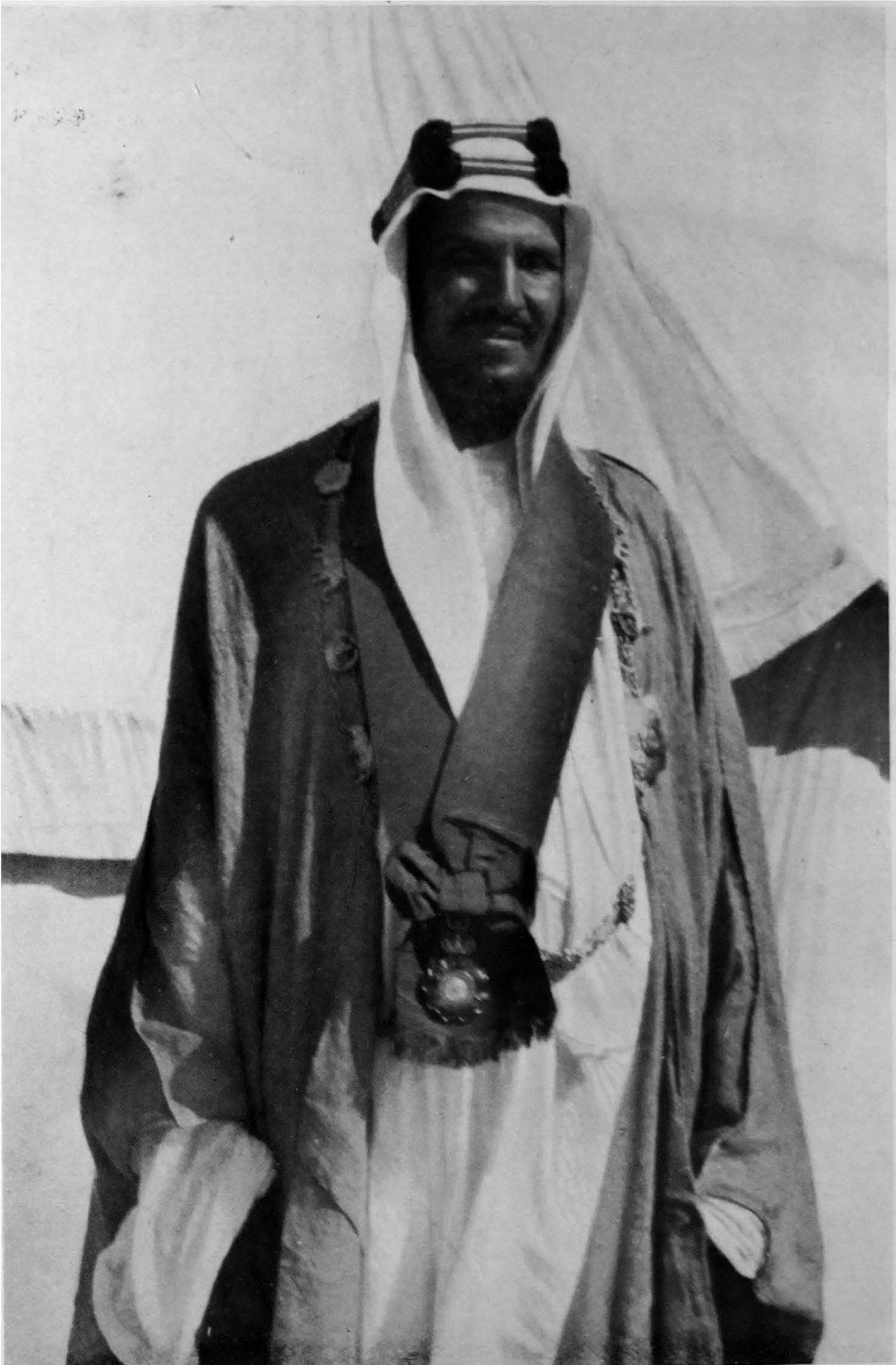
IN UNKNOWN ARABIA



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H.H. ABDUL AZIZ IBN ABDUL RAHMAN IBN SAUD, G.C.I.E., SULTAN OF
NAJD AND ITS DEPENDENCIES.

Frontispiece.

IN UNKNOWN ARABIA

BY

MAJOR R. E. CHEESMAN, O.B.E.

REGULAR ARMY RESERVE OF OFFICERS; HIS BRITANNIC MAJESTY'S CONSUL
IN NORTH-WEST ABYSSINIA; FORMERLY PRIVATE SECRETARY TO
THE HIGH COMMISSIONER FOR IRAQ, 1920-23

F.R.G.S.; CORRESPONDING MEMBER OF THE ZOOLOGICAL SOCIETY OF LONDON;
MEMBER OF THE BRITISH ORNITHOLOGISTS' UNION; AWARDED
GILL MEMORIAL (1925) BY THE ROYAL
GEOGRAPHICAL SOCIETY

WITH A FOREWORD BY

MAJOR-GENERAL SIR PERCY Z. COX,
G.C.M.G., G.C.I.E.

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1926

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TO
MY MOTHER

FOREWORD

ON the outbreak of the Great War the author of this intensely human tale of desert travel, impatient, like other patriotic young Britons, to play his part in the struggle, and anxious to avoid the inevitable delay involved in qualifying for a Commission, enlisted in the 5th Buffs, and it was as Lance-Corporal Cheesman of that Battalion that in the summer of 1916 he discovered himself to me at Basra, bearing a line of introduction from an old Service friend. That particular juncture, at the headquarters of Indian Expeditionary Force "D," was one of strenuous preparation for the coming winter's advance up the Tigris, destined, under Sir Stanley Maude's brilliant leadership, to retrieve the disaster of Kut and put us in possession of Baghdad, and the Army machine was working at high pressure for every member of G.H.Q.; but the busiest of us had our occasional hours off, and it needed but the briefest association for the Lance-Corporal and myself to discover a strong bond of sympathy and interest, in the keen love of nature which we both possessed and which even the more serious preoccupations of the moment could not entirely banish from our daily life. It was a link, at any rate, which served to keep us in close touch for the next seven years, during the last three of which Captain Cheesman, having in the meanwhile obtained his Commission, was a valued member of my personal Staff as High Commissioner of Iraq. Throughout this latter period we continued to develop, as opportunity offered, and under the easier conditions of peace, the natural history collections of which the foundations had been fitfully laid during the vicissitudes of the War.

It was primarily in the interests of zoology that Major

Cheesman planned his recent expedition to an unexplored tract of Eastern Arabia, of which he gives an account in the volume before us, and such an eminent naturalist as Lord Rothschild has borne cordial testimony to the value and interest of the results which he achieved, especially in the domain of ornithology. But while Major Cheesman's proficiency as a field-naturalist makes his observations, when treating of the fauna of the region, of particular weight and interest, his activities were by no means confined to that sphere alone. On the contrary, realising before he started that both geographical and archæological interest attached to the region which he hoped to explore, he was at pains to prepare himself by preliminary training and study—as serious travellers must do nowadays if they hope to do work of any value—to deal efficiently with such problems as might present themselves ; and the result is that he has been able to make valuable contribution to our store of knowledge in both directions.

For example, in that of geography he has not only lifted the veil from the "mystery" settlement of Jabrin, which for generations had been a name to conjure with among travellers and geographers interested in the Arabian peninsula, but he has been able to throw some useful light on the question of the drainage of the Najd uplands, a problem which has puzzled geographers from the earliest times.

Again, in the domain of archæology it will be found that the information and evidences obtained by him during his two visits to the shores of the Salwa bight, while they fall short of absolute proof, constitute strong grounds for the conclusion that the site of the Gerra emporium of the ancient geographers is to be found in the immediate vicinity of the present port of Oqair, and not at the head of Salwa Bay as was formerly supposed.

So much for the scientific or technical aspects of his journey. If we turn to the narrative itself we find in it a vivid, unvarnished record of desert travel, pursued often

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under the most trying circumstances, with imperturbable patience and perseverance, enlivened throughout by a quiet sense of humour which constantly asserts itself and enables the traveller to keep good heart and make light of his difficulties.

Finally, though by common consent and understanding politics were to be strictly taboo, Major Cheesman's pages give us intimate glimpses of the regime of His Highness Abdul Aziz Ibn Saud, G.C.I.E., Sultan of Najd and its Dependencies, and now in occupation of the Hejaz and its Holy Places, who at the present time is such an outstanding figure in the Arab world, and for whom the intercourse of fifteen eventful years has left in me feelings of strong personal affection for the man and the friend, and profound admiration for the great qualities of self-reliant courage and statesmanship which have contributed so much to the shaping of his destiny.

P. Z. Cox.

Athenæum Club,
January, 1926.

INTRODUCTION

IN the year 1908 Lieutenant Boyd Alexander was giving me an outline of his plans for his next journey across the African desert. He had successfully crossed the continent from the Niger to the Nile, and was contemplating an even more hazardous route through to the north of his previous journey, taking in some of the waterless country of the Sudan, where he hoped to find new forms of birds and animals affected by their desert environment and differing from those of the jungle regions to the south. His grief at the loss of his brother, Captain Claud Alexander, and Captain Gosling, his companions in the Niger to the Nile expedition, had not been softened by the passing of time, and he was determined to travel alone. I asked him if he could take me, and he thought it over seriously for a moment and replied: "No, you don't want to leave your bones in Africa, do you?"

I said I should have to leave them somewhere, I supposed, and we both laughed.

He went on to unfold his hopes, if he came safely through, of making yet another journey, this time into the Arabian Desert, where no ornithologist had ever been, and where he was certain that new races of birds would be found. To trace the connection between these birds and those of the African Desert was one of the tasks still awaiting the ornithologist, he said, and it was to him a problem of absorbing interest.

On April 2, 1910, two years after this conversation, brutal assassins in Nieri, Central Africa, cut short the brave young life of a man who had already accomplished great things and whose loss to geography and ornithology can never be estimated or adequately mourned. For the next six years my own life was cast in pleasant places, in the

fair county of Kent, and a journey beyond the confines of the county horizon was an event. It would have been a bold fortune-teller who would have prophesied the usual "long sea journey." Then came the fateful August of 1914 and my enlistment in the "Buffs" lest the War should be over in three months one way or the other. Some people proved by indisputable figures that the Germans had neither men nor money to last six months, and were willing to expound this twenty times a day to all who were not too busy getting into khaki to listen to them. Then came high-pressure training to fit the Battalion for France, then rumours that secret orders had arrived that we were to embark for an unknown destination, then an issue of topees and thin khaki drill, followed by a year in India, more intensive training, another embarkation for an unknown destination, and disembarkation in Mesopotamia. Active service at last, eighteen months after the declaration of war—and with the Germans still holding out.

It was in the early summer of 1916 that I first met Lieutenant-Colonel Sir Percy Cox in Basra. He was Chief Political Officer to the Mesopotamia Expeditionary Force throughout. I had risen to be a Lance-Corporal, and was attached to General Headquarters, 3rd Echelon, in Basra. The birds in Mesopotamia were entirely new to me, and Sir Percy was the first ornithologist I had met in the country. Although he had the advantage of a long acquaintance with the birds of the Persian Gulf, his knowledge of the Iraq species was as scanty as mine; but he shared with me the desire to know them better, and we began that summer the collection which has now reached several thousand skins. During the period of the War he lent me a gun, my 12-bore, which I had brought out disguised and concealed in a kit-bag, having been lost in the battle of Shaikhs Saad. He also had access to literature, so that we were able to identify specimens as additions were made, and Captain N. B.

Kinnear of the Bombay Natural History Society, in addition to his military duties, was always ready to identify specimens sent by post.

On getting a Commission in the Indian Army, I was sent to Shaiba in the autumn, and all day and night a stream of migrant birds was passing over our tents towards the south, heading, as a glance at the map will show, for the Arabian Desert. Thinking over the journey and Boyd Alexander's words, I began to wonder whether fate, having by a miracle brought me so near, could ever be tempted further into allowing me to see the interior. The possibility seemed remote.

The end of the War saw me returning to Baghdad in August, 1920, as Private Secretary to Sir Percy Cox, the first High Commissioner for Iraq. On the journey out we had halted at Oqair in the Persian Gulf to meet H.H. Abdul Aziz Ibn Saud, the Sultan of Najd, in order to discuss matters of high politics. Here we saw the outskirts of the Great Desert from another point of the compass; this was, moreover, its entrance gate. During the next three years, the foundation of the young kingdom of Iraq left His Excellency and his staff little time. The day's work monopolised most of the daylight and often lasted far into the night. Sir Percy Cox, however, brought out at his own expense an Anglo-Indian skinner who had been trained by the Bombay Natural History Society, and during those three years at Baghdad this professional was sent on excursions which we were unable to undertake ourselves, into the farthest regions of King Faisal's territories and among the islands of the Persian Gulf, while we contributed such species as were within the reach of short journeys, and many were sent in by local enthusiasts and sportsmen. The skins were sent in batches to the British Museum (Natural History), where the authorities kindly stored them. Dr. C. B. Ticehurst worked out the birds on his occasional visits to London and kept us informed as to what were wanted, while

Mr. Oldfield Thomas, of the British Museum, gave similar assistance with the mammals. Thus we were enabled to keep the collecting on systematic lines.

These collections only fed the flame of the desire that was in me to know what species inhabited the centre of Arabia. There was nothing from the South in the museums of the world with which to compare our specimens. There had been nibblings all round the coast, but our knowledge of the fauna of the centre of the Arabian peninsula was as much a blank as the map of the same area.

The larger portion of the Great South Desert lies in the domains of the Sultan of Najd : " sphere of influence " would perhaps better describe a country which is mostly uninhabited and featureless, and where no boundaries can or do exist. Sir Percy Cox and I had often discussed the ways and means of getting a collector into the interior. The fervour of Wahhabi Muhammadanism and the fanaticism of some of its disciples made it impossible to send an Anglo-Indian, who, whatever his religion, would be classed as an idolater. The slightest indiscretion on his part might bring the wild tribesmen about him like infuriated hornets, and the consequences would be serious. The first step southward was obviously to obtain the approval and co-operation of the Sultan himself. This could only be procured if the traveller could be adjudged above suspicion of having any ulterior motive. The idea of making a collection of birds and animals, and that only, is difficult of conception by the mind of an Arab. It was equally important, in order to obtain the sanction of the scheme by the British Government, that the naturalist should be one who could be trusted not to throw sparks, even innocently, into the powder-magazine of Arab politics. It was also obvious that the man must be a field naturalist. Sir Percy Cox was the only man who could fill all three of these rôles, but, as he could not undertake the journey himself, I hoped that if he named me as his deputy, his implied guarantee would satisfy all parties.

At a meeting between Sir Percy Cox and the Sultan, at Oqair, in December, 1922, the latter was asked whether he had any objection to my travelling in his country in order to shoot birds and collect skins. The reply was characteristic: "He is welcome; but the birds are only the common ones."

We were leaving Iraq in May of the following year, and my duties prevented me from availing myself of the invitation ultimately extended, until after I reached England, so that it was not till October, 1923, that I embarked at Manchester to fulfil my great ambition. But at that time it was by no means certain that I should even see the Arabian coast. Several months had passed. In the constantly fluctuating tides of Arabian affairs the possibilities of to-day become the impossibilities of to-morrow. It was necessary to prepare for the disappointment of having to turn back from Bahrain with nothing accomplished.

The chance of getting into the southern desert was more remote still. Probably I should have to be satisfied with a journey along the caravan route to Hufuf and Riyadh, skirting the northern boundary of the Great Desert, a road already trodden by some dozen Europeans. Luckily for me in that case, they had left the fauna severely alone, allowing it to remain a blank page to be filled by those who should follow. I was carrying a letter from Sir Percy Cox to the Sultan, mentioning several places he would like me to visit if circumstances allowed. The name of Jabrin was included, but as I knew that there were no caravans passing or visiting it, that it was, in fact, isolated in a waterless desert, there seemed little chance of getting there. It was for these reasons that it had been denied to European eyes, and had been seen even by very few Arabs. Its palm-groves were surrounded by a veil of mystery, and many were the tales of wonder and magic told by the superstitious badawin who graze their camels in the vicinity. It is perhaps small wonder that this

journey took precedence in my own mind over all others. It also meant entering the land of my desire, the northern portion of the Great South Desert.

At length Bahrain and Oqair were passed, and the murmuring camels landed me at Hufuf. There were pale desert forms here, of bird, beast, and reptile, all new to me. Every day the work of collecting seemed well worth while, something fresh being either secured or marked down for a future excursion. Moreover, the suggested journey to Jabrin had not been turned down by the Sultan. It had been spoken of as a possibility, if not a probability. There was only one obstacle. There had been no rain in the South country for a year, and the bushes had not grown sufficiently to provide food for the camels. It was nine days' journey to the oasis. The camels could go without water for that period, but we should have to wait till there was rain, and then till there was sufficient grazing to sustain our beasts on the road. It was a long wait, but at last the rain came, followed by the green buds and branches on the desert bushes.

One morning a bearded and unwashed traveller was seated on a sandstone ridge. His skin had peeled from his face in large patches, and what was left was burnt nearly black by the sun. In spite of all this he was a happy man. The Arabs were making coffee in a sheltered hollow, the camels were grazing in the background. The ridge overlooked a depression which lay to the south. In the middle of the picture was a broad black patch surrounded by a frame of palest gold, shimmering in the heat of a tropical winter sun. There were the palm-groves of Jabrin, nestling in a world of desolation and of sand. The very isolation of the place gave it grandeur. The traveller's mind had gone back many years.

"No," he said. "He was right. I did not want to leave my bones in Africa. I am glad to have brought them to Arabia, to carry on the work that he would have done so much better had he but lived."

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APPENDIX I

MAMMALS

IN a list of Arabian mammals of the eastern side of the peninsula mention must be made of the Whales, although very little has ever been recorded. At least one species of the bigger Whales pays annual visits to the sea on the coast of Hadhramaut and to the Persian Gulf. Blanford in his *Eastern Persia* identified it as *Balænoptera indica*.

It might be assumed that these Whales come from the South Polar regions to breed in the warmer seas. On the other hand, in November, when I saw them, they ought to have been in the south for the Polar summer. If they are from the north it is not easy to explain their annual journey into a sea that is landlocked northward. Sir Arnold Wilson has drawn my attention to old references to Whales in the Persian Gulf by both Arrian and Strabo, and that in which Arrian mentions that Nearchus' sailors measured one of 50 cubits, and he has heard that as recently as October, 1921, six Whales had been stranded on Kishm Island. I have extracted three records from my own diary: October 26, 1923. Whales plentiful three miles from the Hadhramaut coast between Mukalla and Ras Fartak; on the next day more were seen some 200 miles nearer Oman, and on November 1, 1923, three Whales were observed spouting in Bandar Abbas harbour.

A systematic collection of data on their arrival and departure from these waters, the identification of the species, and some record of their number if more than one is observed, would produce valuable results.

The Porpoise is also numerous and extends the whole length of the Persian Gulf. It is almost a daily event to pass a large patch of rough water caused by hundreds of small dark Porpoises, either young or of a very small species, and all more or less of one size. They leap from the water in schools, but do not play in front of the bows of a ship as the larger individuals do. Porpoises and Dolphins are synonymous. Although the name

Dolphin is generally acceded to the species with the longest snouts, this feature intergrades throughout the whole family. The Whales and Porpoises can be distinguished from the large fishes by their horizontal tail. The tail-fins of all fish likely to be confused with them are perpendicular.

The best-known of the marine mammals is the Dugong, the "Mermaid" of early voyagers in the Indian Ocean. Specimens have been secured at Aden and other places in the Red Sea. They belong to the order of Sirenia or vegetable-feeding Whales, do not grow to a great size, and frequent shores and bays in preference to the high seas. Their habit of raising their round heads out of the water and of suckling their young and carrying them under the fore-fin gave rise to the legend of a being half human and half fish. The range of the Dugong extends from the Red Sea to North Australia. For a small consideration credulous travellers are still shown these creatures preserved in glass cases at some of the Red Sea ports, any deficiency the human-like half may have in its resemblance being amply made up by the decorative resources of the taxidermist.

It has been considered of sufficient interest to add a list of the animals mentioned in the few papers existing that deal with South and South-eastern Arabian mammals.

"On Five New Mammals from Arabia and Persia," by O. THOMAS, *Annals and Magazine of Natural History*, Ser. 7, Vol. X, December, 1902.

Genetta grantii, Grant's Genet and *Meriones buryi* (both from S. Arabia); *Vulpes vulpes arabica* (Arabian Fox from Muscat).

"On some Specimens of Mammals from Oman, S.E. Arabia," by O. THOMAS, *Proceedings of the Zoological Society of London*, May 1, 1894.

Xantharpyia amplexicaudata, Fruit Bat.
Taphozous nudiventris, Sheath-tailed Bat.
Rhinopoma microphyllum, Long Wire-tailed Bat.
Erinaceus niger, Black Hedgehog.
Crocidura murina, Shrew (Musk Rat).
Herpestes albicauda, White-tailed Ichneumon.
Canis pallipes, Indian Wolf.
Vulpes leucopus (now *arabica*), Arabian Fox.
Gerbillus (Dipodillus) dasyurus, Naked-soled Gerbil.

Mus (now *Rattus*) *rattus*, Black Rat.
Lepus omanensis, Oman Hare.
Gazella muscatensis, Muscat Gazelle.
Oryx beatrix, Arabian Oryx.
Hemitragus jayakari, Thar or Wild Goat.
Procavia syriaca jayakari, Rock Dassie.
Tursiops tursio, Bottle-nosed Dolphin.
Grampus, sp., Risso's Grampus.

"On the Mammals of Aden," by Col. J. W. YERBURY and O. THOMAS, *Proceedings of the Zoological Society of London*, June 18, 1895.

Papio hamadryas, Aden Baboon.
Xantharpyia straminea, Fruit Bat.
Xantharpyia ægyptiaca, Fruit Bat.
Triænopus persicus, Bat.
Hipposiderus tridens (*Asellia tridens*), Trident Leaf-nosed Bat.
Nycteris thebaica, Bat.
Scotophilus schlieffeni, Bat.
Vespertilio dogalensis, Bat.
Coleuva afra, Bat.
Taphozous perforatus, Sheath-tailed Bat.
Rhinopoma microphyllum, Long Wire-tailed Bat.
Crocidura russula, Shrew.
Crocidura etrusca, Pigmy Shrew.
Erinaceus, sp., Hedgehog.
Felis maniculata, Wild Cat.
Felis caracal, Caracal.
Herpestes, sp., Mongoose.
Hyæna hyæna, Striped Hyæna.
Canis aureus, Jackal.
Vulpes nilotica (now *V. arabica*), Arabian Fox.
Gerbillus dipodillus pæcilops, Dipodil.
Gerbillus dipodillus lixa, Gerbil.
Gerbillus hendecapleura famulus, Gerbil.
Meriones rex, Jird.
Arvicanthus variegatus.
Mus (now *Rattus*) *rattus*, Black Rat.
Mus gentilis, House Mouse.
Acomys dimidiatus, Spiny Mouse.
Hystrix leucura, Porcupine.
Lepus arabicus, Arabian Hare.
Gazella, sp., Gazelle.

Capra sinaitica, Ibex.
Halicore dugong, Dugong or "Mermaid."
Balænoptera, sp., Rorqual.

R. E. C.

The following paper was first published in the *Annals and Magazine of Natural History* (Ser. 9, Vol. XIV. p. 548, November 1924), by whose courtesy it is here reprinted.

On the Mammals collected in the Desert of Central Arabia by Major R. E. Cheesman between November 1923 and March 1924. By R. E. CHEESMAN and MARTIN A. C. HINTON.

The collection of mammals described in this paper was made by Major R. E. Cheesman in the Hasa Province and in the Jafura and Jabrin Deserts which form part of the Great Southern Desert of Arabia. As might be expected in a district so widely different from the surrounding areas, many forms have proved to be new.

Generally speaking the exceptionally pale desert coloration is the most striking feature of the collection as a whole; and to match it to some degree one has to proceed far to the west, where in the Aïr district of the Central Sahara Captain Angus Buchanan found some little time ago an extraordinarily pale assemblage of mammals. It is of interest perhaps to note that certain inferences as to the special habits of some of the numerous and competitive species of *Meriones* and *Faculus*, found living together in close local association, derived independently from a study of the skull structure, find confirmation in, and in turn confirm, the observations made in the field to a remarkable degree.

There is reason to suppose that the list given of animals obtained or seen between Hufuf and Jabrin would apply to the whole of the Great South Desert, there being, so far as is known, no physical barrier until the confines of the mountains, such as Aden and Yaman to the south and Muscat to the east, are reached, where markedly darker forms are known to replace the desert fauna. The entire absence of the Mongoose, so plentiful in Iraq, and the replacement of the big dark Iraq Hare by the small pale desert-coloured Hare give definite evidence as to the limits of range of each of the species concerned.

The breeding-time of the few species on which any information was procurable is noteworthy, as in these cases it coincides with the bursting of the desert scrub into new spring growth.

- Arabian Fox (*Vulpes arabica*). Cubs in March.
Al Rimal Desert Jird (*Meriones arimalius*). Young on February 23.
Cheesman's Hare (*Lepus omanensis cheesmani*). Young on February 25.
Pipistrelle Bat (*Pipistrellus kuhli*). Young in May.

TRIDENT LEAF-NOSED BAT

1. *Asellia tridens* Geoff. Arabic "Seha," any Bat; also "Keshaf al Layl."

Hufuf. ♂ 5061, 5077; forearm 50, 51 mm. ♀ 5076; forearm 49 mm.

These specimens were collected in December and are all in the pale fawn pelage; in size they agree with the typical subspecies from Egypt, and for the present, at all events, must be referred to *A. t. tridens*.

A subspecies, *A. t. murraiana*, distinguished by its slightly larger size, has been described from Karachi and Bushire by Anderson. Specimens from Lahej, Southern Arabia, and the Sinai Peninsula have also been referred to this form. In working out the Hufuf specimens we had a series from Baghdad before us. In six males from Baghdad the forearm measurement ranged between 49 and 56 mm., while in two females it was 53 and 55 mm., indicating that, on the ground of larger size, the Baghdad examples should be referred to *A. t. murraiana*.

At Baghdad soon after sunset these Bats can be seen in thousands crossing the Tigris. Flying close to the ground, they leave the city and take to the desert in a continual stream. The same low-flying habit was noticed in Arabia. At Hufuf they did not come out of the town, but seemed to arrive from the calcareous sandstone hills outside. On these hills there was evidence of large colonies in all suitable crevices, though no Bats were actually secured upon the hills themselves. Anderson states that this species is recorded from Senegal, Algeria, Tunisia, Southern Syria, and Zanzibar; while in Egypt it occurs in the Tombs of the Kings and other monuments. In one of the Tombs of Assasif, Egypt, they occur in vast numbers, and on striking a light Anderson was surrounded with a cloud of bats; the sickening stench of this swarm, combined with the oppressive heat of the tomb, quickly drove him out into the open air. This description exactly corresponds with an account

of the Bats in a deep cave in Jabal Qara, near Hufuf, as narrated by Muhammad Effendi, a Revenue official.

The species is remarkable, like some other Leaf-nosed Bats, for possessing a brilliant red (almost vermilion) colour-phase. None so coloured were observed in Arabia or Iraq, but many examples were collected by Admiral Lynes in Darfur in February and May 1920 (*Proceedings of the Zoological Society of London*, 1923, p. 249).

THE HOBGOBLIN BAT

Otonycteris jin. sp. n.

Hufuf. ♂ 5066, 5072, 5073, 5074, 5075.

Distinguished from the other known members of the genus by its larger size, longer and denser fur, pallid colour and more inflated auditory bullæ.

Size large (forearm 64–66 mm.; condylo-incisive length of skull 22.4–23; upper tooth row 8.5–8.8; the corresponding ranges in the other known species are: 58–61; 20.9–22.3; 7.8–8.2).

Fur longer and much denser than in the other species; hairs of back about 10 mm. long. General colour of upper parts near the "pallid purple drab" of Ridgway, lightened by the partly visible white basal portions of the hairs. Under-parts pure white. Membranes and ears very pale.

Skull distinguished from skulls of *Otonycteris hemprichi* and *Otonycteris petersi* by its slightly larger size, heavier build, more inflated auditory bullæ, and larger teeth.

Dimensions of the type measured in the flesh:—Head and body 73 mm.; tail 57; hind-foot 11; ear 40.

Skull measurements:—condylo-incisive length 22.9; zygomatic breadth 15.1; postorbital constriction 4.1; interorbital breadth 7.1; width of braincase 11; width of occiput 11.7; median height of occiput 8; upper tooth row (C-m³) 8.5.

Type.—Adult male, B.M. No. 24.8.2.2. Original No. 5073. Collected at Hufuf town, Hasa, Arabia, on December 10, 1923, and presented to the British Museum by Major R. E. Cheesman. Altitude 200 ft.

Hab.—Hufuf, Hasa, Arabia.

Bats of this genus are extremely rare, and the five now received from Hufuf almost double its representation in the national collection. They were met with only in Hufuf town, and were there very uncommon; the five collected were the only examples

seen, though on numerous occasions special evening excursions were made to observe them.

This Bat has a slow, flopping flight, progressing more slowly than any other. It resembles a large tired butterfly and usually steers a straight course, though on occasions one was seen to turn to catch a fly.

The Hobgoblin Bats were extremely punctual and left the town three-quarters of an hour after sunset, flying towards the palm gardens, and they could be depended on to take the same course night after night. If it was windy, they did not come at all, and one was seen to set forth and return in a few minutes because the wind had suddenly begun to blow.

The ears are carried in life in this shape, but it is not possible to preserve this in the dried skin. The wing-spread measures 420 to 450 mm., while the tail protrudes 7 mm. beyond the filament.



THE IKHWAN PIPISTRELLE

Pipistrellus kuhli ikhwanius.

Hufuf town. ♂ 5062, 5069; ♀ 5067, 5068, 5078, 5148.

Distinguished among the subspecies of *P. kuhli* and from all other members of the genus, with the exception of *P. coxi* (which is white), by its extremely pale colour.

Essential characters as in the typical subspecies. Size rather small (forearm 33–34 mm.; condylo-incisive length of skull, 12.3).

General colour above, light buff, darkened by the partly visible dark-grey hair-bases. Under-parts white. Membranes pallid. Interfemoral membrane densely clothed with short light buff hair above between the thighs and the base of the tail. Margins of wing membranes whitish as usual.

Dimensions of type measured in the flesh:—Head and body 43 mm.; tail 33; hind-foot 7; ear 10.

Skull:—condylo-incisive length 12.3; zygomatic breadth 8.2; interorbital constriction 3.5; lachrymal breadth 5; breadth of braincase 6.2; mastoid width 7.4; depth of braincase in middle 4.5; upper tooth-row (C-m³) 4–6.

Type.—Adult male, B.M. No. 24.8.2.1. Original No. 5069. Collected at Hufuf town on December 7, 1923, and presented to the British Museum by Major R. E. Cheesman.

Hab.—Hufuf, Hasa, Central Arabia.

Among the material used for comparison were two specimens obtained at Bahrain and three from Fao, which form part of the Cox-Cheesman collection and are referable to *Pipistrellus kuhli*. The Hufuf Pipistrelles are, however, very conspicuously paler, both as regards their fur and their membranes, than any other form of *P. kuhli*.

This is a common Bat in Hufuf town, and most small Bats seen are of this subspecies. They are very active and difficult to secure. Several lodged behind the date-log ceiling of the veranda of a house and they seemed to live in pairs. Half an hour after sunset they would come out singly; and two or three hours later the one which had remained at home would begin to chirrup, a noise which foretold the return of the wanderer. Specimens of *P. kuhli* collected at Fao had two young at breast in May.

HEDGEHOG

? *Paraechinus dorsalis*. Arabic "Qunfud." Badawin "Daalij."

South Hasa :—imperfect skin of a Hedgehog, eaten by a Fox. Judging from what is left of this specimen the skin belonged to a species of *Paraechinus*, probably related to *P. dorsalis* of the Hadhramaut.

Major Cheesman saw the tracks of a Hedgehog in the bushy sand-dunes of the Jafura Desert, but did not find a live specimen.

WILD CAT

Felis sp.

A Wild Cat was mentioned by the Al Murra tribesmen as being seen by them in their wanderings towards the centre of the Great South Desert—Al Rimal. This would prove a very interesting animal if specimens could be obtained. It was said to be larger than the domestic cat, with a much shorter tail.

STRIPED HYÆNA

Hyæna hyæna Linn. Arabic "Dhaba."

Footmarks of Hyænas, probably of this species, were seen as far south as Jabrin, where they were apparently plentiful, although no specimen was obtained. What they can find to live upon when the tribes move away with their camels is a mystery.

The range of this species extends from North Africa through Palestine, Persia, Trans-Caspia, and India.

Fox

Vulpes arabica. Arabic "Husaini." Classical "Thalib."

No specimens.

Several Foxes were seen in the chalky sandstone hills Jabal Abu Ghanima, three miles northward of Hufuf.

They resembled in size and appearance the small Desert Foxes in Iraq (*Vulpes persica*), and in one seen at close quarters the black breast was conspicuous.

A live cub was brought from Kuwait by Mrs. F. Holmes and was presented to the London Zoological Gardens. The vixen had been killed by Arabs just outside Kuwait, and the three small cubs were brought into the town in March, 1924. The first coat was a uniform pale sandy colour, and with its large ears the animal looked more like a Fennec Fox, but at the first moult, at the age of a little over six months, the black chest, black behind the ear, and white tip to the tail developed, all typical characters of the larger or *leucopus* group of Foxes to which *Vulpes persica* belongs.

INDIAN WOLF

Canis pallipes Sykes. Arabic "Dhib."

Not uncommon at Hufuf and Jabrin, but only footmarks were seen.

A specimen from the Cox-Cheesman collection is now alive in the London Zoological Gardens. Its coat is remarkable for its pale grey coloration. It was obtained by La Personne in the Persian Gulf as a cub.

THE JACKAL

Canis aureus Linn. Arabic "Wow-wi."

Hufuf. 1 ♀. Ear measurement 76.

Plentiful in the gardens of the Hufuf oasis, but not seen outside, or at Jabrin. They have bright-coloured coats, and the hair is long.

THE RATEL

Mellivora sp. Arabic "Dhribān."

Only one Ratel was seen. It was surprised at close quarters, in the trough of sand-dunes in Jafura Desert. It was a darker

grey on the back than the specimens seen in Iraq, but this seems to vary with age, the youngest being the lightest.

MERIONES, or JIRDS (rat-like desert rodents)

This genus is represented by four very distinct forms, distinguished from each other by characters of skull and pelage, which appear to be closely correlated in each case with special habits and the peculiar environment. Thomas¹ has already shown that "a single district may contain two or three species, all looking so alike as to be readily confused with each other, and yet really distinguishable on close examination"; and that the differences in the structure and development of the auditory bullæ afford the primary means of distinction and enable us to separate the species into four groups. The present collection confirms these views of Thomas; while the field observations suggest an explanation.

The first species, described below as *M. ismahelis*, is a member of Thomas's *a* group, closely related to *M. crassus*, of Sinai. In it the bullæ are enormously developed, the coat very dense and long, and the colour very pale. It is confined to the sand-dune desert and is a strictly nocturnal animal. In this it agrees with *M. crassus*; for Hedenborg, who collected the original specimen of the latter species in Sinai, described it as "Nocturnus, prædatur ante lucem."² The extravagantly developed bullæ appear to indicate, therefore, that in the darkness the animal has to rely chiefly upon its sense of hearing for protection from its enemies; while its unusually heavy coat is no doubt to be correlated with the low night temperature of the desert.

M. arimalius, the second species described below, is also related to the members of the *a* group, its closest affinities being apparently with *M. pelerinus*, described from N.W. Arabia. This species inhabits the true desert; it is a diurnal rodent, scampering about on the hot sand outside its burrows and feeding at all times except during the hottest hours about noon. In it the bullæ are considerably less developed, suggesting that both sight and hearing are relied upon for defence. The coat is very thin and short, sufficient to protect its wearer from the sun, but not developed as a special defence against the night cold. The exceptionally pallid colour would seem also to be directly correlated with the diurnal habits.

¹ Thomas, *Ann. & Mag. Nat. Hist.*, Ser. 9, Vol. III., 1919, p. 263.

² Sundevall, *Kongl. Vetenskaps-Acad. Handl.*, 1842, p. 233.

The remaining two forms treated as subspecies of *M. syrius* are much less specialised. They are not inhabitants of the true desert, but are found along the borders of the cultivated fields at Hufuf, where lucerne is grown; and upon this plant they feed. At Hufuf there are two rivulets, one fed by the Khorasan spring, the other by the Khadud spring; and it is upon the banks of these rivulets that the lucerne is grown. Between the streams there is a bare chalky sandstone plateau about a mile wide, untenanted and uninhabitable by this *Meriones*. It is of interest to find that each rivulet has its own peculiar form of *M. syrius*, the sandstone plateau between being apparently an impassable barrier. One of the forms, *M. s. edithæ*, has the richer colouring of true *syrius* combined with a much stronger skull and an unusually robust body; the other, *M. s. evelynæ*, has the skull and body proportions of *syrius* combined with a pallid dorsal coloration.

NOCTURNAL DESERT JIRD

Meriones ismahelis sp. n. Arabic "Jerai mal burr"; includes most desert rodents except Jerboas.

Hufuf oasis. ♂ 5120, 5121; ♀ 5103, 5104, 5116.

Jabrin oasis. ♂ 5174.

A very pallid member of the *crassus* group, distinguished from *M. crassus* by its smaller size, finer coat, and paler colour.

Size medium (hind-foot about 31 mm.; condylo-basal length of skull up to 36 in adult ♂). Tail as in the other members of the group, short, about equal to head and body measurement.

Fur very fine, dense, and long; hairs on rump about 20 mm. in length. Colour of upper-parts near "light buff" of Ridgway; under-parts, together with the hands and feet, pure white. Upper surface of tail light buff like the back, not "cinnamon buff" as in most other species of *Meriones*. Naked portions of soles light flesh colour, instead of being black as in the *syrius* group.

Skull similar to that of *M. crassus* in general form, but slightly smaller. Auditory bullæ very large, with the mastoid, supratympanic, and premeatal portions greatly inflated as in the related species.

Dimensions of type measured in the flesh:—Head and body 124 mm.; tail 124; hind-foot (without claws) 31; ear 17.

Type.—Adult male, B.M. No. 24·8·2·4. Original No. 5121. Collected at Hufuf oasis on January 7, 1924, and presented to the British Museum by Major R. E. Cheesman.

The nearest relation of this species is undoubtedly *M. crassus*, a species described from Sinai by Sundevall in 1841, characterised by similar length and highly developed auditory bullæ and strictly nocturnal habits.

At Hufuf *M. ismahelis* was sharply contrasted by these habits with the other Jirds, which all feed by day.

The distribution of the members of the *crassus* group is also interesting. They follow the line of true sand-dune desert which connects the great desert areas of Africa with those of Arabia, proceeding from the Sudan to Sinai, thence marching south to the Nafud, to the Dahana and, by yet another name, to Al Rimal (marked on maps as the Ruba-al-Khali) in unbroken continuity. *M. pallidus*, Bonhote, is the African representative of the group and it was described from specimens collected in the Sudan. *M. crassus* is found throughout the desert of Sinai; while *M. ismahelis* extends in Arabia as far southwards as Jabrin.

Although in adult pelage this new species is extremely pale, young specimens are darker and redder, with coats resembling those of *M. pelerinus*, a diurnal species described by Thomas from Tebuk in N.W. Arabia. The coat of *M. ismahelis* is thicker and longer and has a peculiar "broken" or "shingled hair" appearance, very different from the sleekness characteristic of the other species in the neighbourhood of Hufuf.

This species was never found in gardens. Its burrows were made in sand or soft ground in the sandstone plains outside the cultivated area. Each burrow had three or four entrances, which were let down in the horizontal ground, in contrast to those of the *syrius* group, which seem to prefer a perpendicular mud wall or bank.

Major Cheesman never caught more than one at each earth, which suggests that they are solitary. They never appeared until the last glimmer of daylight had gone, say about two hours after nightfall; and they retired to their burrows again before the dawn.

AL RIMAL DESERT JIRD

Meriones arimalius sp. n.

Jabrin. ♂ 5194; ♀ 5195.

Jabal Aqula, Jabrin. ♂ 5205; ♀ 5201, 5206, and two in spirit.

Most like *M. pelerinus* from N.W. Arabia in skull, but outwardly distinguished by its pallid colour, short thin fur and much longer white-tufted tail.

Size large (hind-foot 37 mm.; median length of skull 38·3), the hind-foot and tail much longer than, instead of being about equal to, the length of head and body.

Fur short, and closely adpressed; hair on rump about 10 mm. in length. General colour paler than in any other known member of the genus. Crown of head and centre of back near "cream-buff" of Ridgway, fading on cheeks and flanks to "ivory-yellow." Under-parts, together with the haunches and feet, pure white; the hairs of the ventral surface white. Tail, including its tuft, "ivory-yellow" throughout, with a few scarcely perceptible grey hairs in the tuft.

Skull like that of *M. pelerinus*, but with the auditory bullæ somewhat less developed. In each bulla the mastoid portion is less swollen and terminates posteriorly but little behind the occipital plane; supra-tympanic and premeatal swellings a little less marked.

Dimensions of type measured in the flesh:—Head and body 132 mm.; tail 163; hind-foot 37; ear 18.

Type.—Adult male, B.M. No. 24·8·2·5. Original No. 5194. Collected at Jabrin on February 22, 1924, and presented to the British Museum by Major R. E. Cheesman.

This interesting species, the palest by many shades of all known Jirds, is essentially an inhabitant of the sand-dunes of the Great South Desert of Arabia, and it was not found north of Jabrin. Its long, pale, cream-coloured tail, lacking all trace of the cinnamon tint and black fringe so generally found in *Meriones*, sharply distinguishes it from all related species. This Jird feeds exclusively on the bush *Arthrocnemon fruticosum*, called "Gadha" by the Arabs, and its earths were only found on the gadha-covered dunes of soft white sand. It is a diurnal species, feeding throughout the day with the exception of the hottest hours about noon; and the smaller development of the auditory bullæ, as compared with those of *M. pelerinus*, is no doubt correlated with the daylight activities of the animal.

They are shy, and any movement causes a stampede. They then sit inside the holes, and as long as there is a suspicion of danger they make a warning note resembling a ticking sound, as if a man were marking the seconds by knocking two sticks together. While the noise continues no Jird will show itself.

One immature specimen just able to run was caught on February 23, but was spoilt by the trap.

THE KHADUD JIRD.

Meriones syrius edithæ subsp. n.

Khadud Springs, Hufuf. ♂ 5129, 5132; ♀ 5131.

A powerfully built subspecies, distinguished from the typical form by its longer and redder tail and heavier skull.

Fur sleek and moderately long; hair over rump about 14 mm. in length. Colour of upper-parts warmer and richer than in *M. s. evelynæ*, near the "pinkish cinnamon" of Ridgway upon the crown of the head and back. Under-parts pure white, the bases of the white hairs grey. Hands and feet white, washed with cream-buff above; naked parts of soles black. Tail "ochraceous salmon," with terminal pencil of long black hairs.

Skull more massively built than in typical *syrius*, with stronger supraorbital beads, and longer palatal foramina. Dorsal edge of masseteric plate thrown somewhat further forward. Bullæ slightly more inflated.

Dimensions of type measured in the flesh:—Head and body 143 mm.; tail 181; hind-foot 37; ear 18.

Type.—Adult male, B.M. No. 24·8·2·6. Original No. 5129. Collected by Major R. E. Cheesman at Khadud Spring, Hufuf, January 10, 1924.

Hab.—As above.

This subspecies has been named in honour of Miss Edith Cheesman.

It is surprising to find that the Jird living in gardens watered by the Khadud spring, Hufuf, is of a redder colour and stronger and bigger subspecies than those found in the gardens watered by a separate though neighbouring spring, the Khorasan. As the differences are evident in the examination of the series of skin and skulls, it has been decided that they are sufficient for separation subspecifically from *syrius* and each other.

The springs are not mere wells, but are flowing streams watering considerable areas.

The gardens and crops are similar, but are divided by a mile of chalky sandstone plain which seems to constitute an impassable barrier. Both subspecies live an artificial life in holes at the base of mud walls surrounding the lucerne fields, and feed on the young leaves and shoots. They do a lot of damage when they are numerous, and a strip of the crop along the walls is bitten short in much the same way as when rabbits attack part of a field of corn in England. They are pugnacious, and contests are frequent in which biting each others' long tails plays a conspicuous part; consequently few tails are unmutated

and some are stumps. They feed by day and throughout the day, and have the smaller bullæ associated with this habit. The tail is carried straight and rather high. Jirds were not seen to carry the tail over the back nor to use it to support the animal as a prop, as in some illustrations.

THE KHORASAN JIRD

Meriones syrius evelynæ subsp. n.

Khorasan Springs, Hufuf. ♂ 5047, 5050, 5053, 5059; ♀ 5051, 5052.

An exceptionally pallid subspecies, with the tail much less rufous than usual.

Fur sleek. General colour of upper-parts pale ochraceous buff; under-parts pure white, the bases of the white hairs grey. Hands and feet white, inconspicuously blotched with pale ochraceous buff above; naked parts of soles black. Tail pale ochraceous buff above and below down to the commencement of the black dorsal fringe and terminal pencil.

Skull smaller than that of *M. s. syrius*, but essentially similar in general form and structure. Auditory bullæ relatively larger and more globosely inflated.

Dimensions of type measured in the flesh:—Head and body 144 mm.; tail 156; hind-foot 34; ear 18.

Type.—Adult male, B.M. No. 24.8.2.7. Original No. 5050. Collected at Khorasan Spring, Hufuf, Hasa, Arabia, on November 28, 1923, and presented to the British Museum by Major R. E. Cheesman.

This subspecies has been named in honour of Miss Evelyn Cheesman.

M. syrius evelynæ feeds in the daytime and seems to enjoy the sunshine, and skulls show the lesser developed bullæ of the diurnal Jirds. It is distinguished from *M. syrius syrius* by its paler colour and whiter feet, and from *M. s. edithæ* by its much paler colour and particularly by less cinnamon buff in the tail.

THE GERBIL

Gerbillus arduus sp. n.

Jabal Dharabin, Jafura Desert. ♂ 5162, 5214.

Zarnuqa, S. Hasa. ♂ 5221.

Most nearly related to *G. cheesmani* of Iraq, but with relatively longer hind-foot, slightly paler colour and whiter tail.

General colour of upper parts dull sandy buff, lacking the

warmer ochraceous tint seen in *G. cheesmani*. Under-parts together with hands and feet pure white. Tail with its upper surface very faintly suffused with cream buff in its basal two-thirds; elsewhere white.

Skull and teeth essentially as in *cheesmani*, but the mesopterygoid fossæ shorter and broader and the auditory bullæ (particularly their mastoid portions) a little more inflated.

Dimensions of type measured in the flesh:—Head and body 86 mm.; tail 124; hind-foot 29; ear 12.

Skull:—greatest median length 28.5 mm.; greatest diagonal length 29.2; condylo-incisive length 24.8; zygomatic breadth 15; interorbital breadth 5.3; breadth of braincase 13.5; bi-meatal breadth 15.3; nasals 10.4; palatal foramina 4.1; bullæ, longest diagonal 12.1; breadth of a bulla at right angles to last, exclusive of meatal projection, 5.9; upper molars 3.5 (on crowns), 3.8 (alveoli).

Type.—Adult male, B.M. No. 24.8.2.3. Original No. 5162. Collected at Jabal Dharabin, Jafura, on February 14, 1924, and presented to the British Museum by Major R. E. Cheesman. Altitude 200 feet.

Hab.—Jafura Desert, Central Arabia.

This beautiful little animal is strictly nocturnal. Closely related to *G. cheesmani* described from Iraq, it may later be shown to intergrade with the latter to the north-east, but its differences, the result of a more intense specialisation for life in the desert, entitle it to be treated, for the present at all events, as a distinct species.

Every morning in camp when on the march in dune country some little round footmarks, no bigger than a small pea, were noticed in the sand, and it was some time before our visitors were discovered to be this beautiful little Gerbil. Afterwards it was noticed that temporary holes were always dug by them near the camp, doubtless in order to allow the inhabitants to be on the spot the following night. We eventually caught one in a trap baited with date. They are delicate little nocturnal creatures the size of dormice, with palest shades of desert colouring and large black eyes like boot-buttons.

THE DIPODIL OR NAKED-SOLED GERBIL

Dipodillus dasyurus Wagner.

Dal'aiqiya, Hasa. ♀ 5228.

Only one specimen with skull broken by trap; it is not possible to carry identification further.

Trouessart gives the distribution of *D. dasyurus* as Arabia, Red Sea, and Oman.

This specimen was caught in bushy desert, near a small garden and well. The badawin who brought the trap in did not distinguish it from a House Mouse.

THE BLACK RAT

Rattus rattus Linn. Arabic "Jeraydi."

Hufuf Gardens. ♂ 5126, 5127.

These have brown backs and white bellies and represent the wild original form of the Black Rat.

Major Cheesman did not see one in the town. At Hufuf it was a garden animal living in burrows near the running streams and making stick and leaf nests in the trees.

HOUSE MOUSE

Mus musculus gentilis Brants. Arabic "Fars."

Hufuf Gardens. ♀ 5125.

Not very plentiful and more often seen in the gardens than in the town.

BUXTON'S MOLE RAT

Nesokia buxtoni Thos.

Oqair, Hasa. ♂ 5012.

The colour of the Oqair specimen matches that of the type of *buxtoni* described from Iraq, but the skull is smaller. However, it matches a skull of a male *buxtoni* from Qurna, and there is no doubt that it is the same animal.

The interest of the specimen centres round its appearance at Oqair, where the sand desert comes down to the coast. There is a small patch of rushes a few hundred yards long, and thirty wide, near the sea, but just above high-water mark. In this the little colony of *nesokia* ekes out an existence. Probably the next colony is in Hufuf, removed from them by forty miles of bare sandhills. Their mounds were seen in the Hufuf gardens, but no specimens were obtained there.

ARABIAN JERBOA

Faculus florentiæ sp. n. Arabic "Jarbu."

Jabal Aqula, Jabrin. ♂ 5207.

Jafura Desert. ♀ 5123.

Distinguished from all its geographical allies by its large size, long tail and paler colour.

Size large (hind-foot 55–60 mm.), nearly as in *J. syrius*.

General colour very pale. Top of head and back near "pale pinkish-buff" of Ridgway. On the rump some of the hairs have dark tips, which form peculiar shade markings in the general pattern and are continued over the flanks to the white sides. Under-parts together with hands and feet pure white. Toes heavily booted with long stiff white hairs as usual. Tail pale pinkish-buff above, white below up to the tuft, which is long and white; there is a small patch of "vinaceous slate" where the buff and white meet.

Skull and teeth nearly as in *J. syrius*.

Dimensions of the type measured in the flesh:—Head and body 114 mm.; tail 176; hind-foot 55; ear 22.

Skull:—greatest median length 31.9 mm.; greatest diagonal length to back of auditory bullæ 34.5; greatest breadth across face 21.8; interorbital breadth 11; bi-meatal breadth 22.6; infraorbital foramen, height 6.7; breadth across the two foramina 15; upper molar series (crowns) 4.9.

Type.—Adult female, B.M. No. 24.8.2.8. Original No. 5207. Collected at Jabal Aqula, Jabrin, on February 24, 1924, and presented to the British Museum by Major R. E. Cheesman.

Hab.—Jabrin, Al Rimal, and Jafura Deserts, Central Arabia. Altitude 200 to 400 feet.

This Jerboa is named in honour of Mrs. F. M. Cheesman.

The Jerboa of the Jabrin Desert is distinguished as being the palest known member of the genus, more pallid even than *J. airensis*, the form inhabiting the district of Aïr in the Western Sahara. *J. loftusi*, described from Mohommerah, Persia, and its subspecies, *J. c. vocator*, described from Seeb, twenty-two miles N.W. of Muscat, are smaller and darker; while *J. j. syrius*, described from Karyatein, in the Syrian Desert, has a coat which contains brown and greys almost too dark to permit them to be described as having a desert coloration.

The study of this Arabian material leads us to think that *syrius* and *vocator*, described by Thomas as subspecies of *J. jaculus* and *J. loftusi* respectively, will eventually have to be treated as full species.

In the north-east of Arabia *J. florentiæ* reaches the coast of Kuwait, thus interrupting the range of *J. loftusi*. This coastal representative is slightly darker than the typical form of the

central deserts and it may therefore be described as a subspecies as follows :

Faculus florentiæ oralis, subsp. n.

Essential characters and size as in *F. florentiæ*. Colour noticeably darker, though conspicuously lighter than in either of the former subspecies of *loftusi*.

Dimensions of type measured in the flesh:—Head and body 120 mm.; tail 197; hind-foot 56; ear 24.

No skull.

Type.—Adult male, B.M. No. 7.11.22.27. Original No. 8.K.6. Collected at Kuwait, April 22, 1907, and presented to the British Museum by Major S. Knox.

Hab.—Coastal region of N.E. Arabia.

A specimen in the Cox-Cheesman collection (No. 1612), from Zobair matches the two examples collected by Major Knox at Kuwait very exactly.

Jerboas dig a straight hole with one entrance which is stopped up from inside with sand or gravel. The end of the tunnel is brought up near the surface, some thirty yards away, but is not opened. When a fox commences to dig at the entrance the Jerboa opens out the hole at the far end and darts off unobserved or with a useful start. The badawin catch them by finding the tunnel near the back exit with their toes, and two men then dig at each end till they meet. The Jerboa has one more ruse. He opens out a short branch tunnel, and unless the man knows this he digs past him. Once a Jerboa is released he is too fast for a man and turns too cleverly for a dog to take him.

CHEESMAN'S HARE

Lepus omanensis cheesmani Thos. Arabic "Arneb."

Jabal Aqula, Jabrin. ♂ 5169, 5204.

Jafura Desert. ♀ 5163.

The first Hare of this species was obtained near Salwa, in Hasa, 1921, and the Jabrin Hares match it well in colour and size.

They are remarkable in the field for their small size, very long ears, and pale desert colouring.

Lepus omanensis from Muscat resembles it in size, but it is darker, and brown, in fact nearer the English rabbit in colour. *L. o. cheesmani* is therefore the desert form and is the creation of the true sand desert.

Apart from its darker colour, *Lepus connori*—the Hare of Iraq—is a much larger animal, as is shown by the following measurements :

Hind-foot of *L. connori* 120 mm., from Sharoban, Iraq.

Hind-foot of *L. arabicus* 100 mm., from Sanaa (San'a), Yaman.

Hind-foot of *L. o. cheesmani* 79 mm., from Jafura Desert.

Skull measurements:—length from back of skull to outside edge of teeth :

L. connori 93 mm., from Iraq.

L. arabicus 80 mm., from Hiswa, east of Aden.

L. o. cheesmani 71 mm., type Salwa.

Lepus arabicus is also one of the darker Hares.

L. o. cheesmani is fairly plentiful from Hasa to Jabrin in the vast gravel plain and sand-dune deserts, wherever a patch of scrub provides food and scanty cover. There are few places where they can hide, so they are dependent on their colour, which resembles the sand, to protect them from their foes. Apparently as long as the animal keeps still it is invisible as far as natural enemies are concerned. A female taken in Jafura, February 25, had two young with her.

They dig earths but only seem to make use of them when hard pressed.

THE GAZELLE

Gazella sp. Badawin "Dhabi."

No specimen.

The tracks of a Gazelle were seen in sand-dunes on the Jafura Desert.

The country between Hufuf and Jabrin had been without a drop of rain for nearly two years, and there was no grazing, which had driven the Gazelle to other districts. The badawin say that when the bushes are growing Gazelles are plentiful in Jabrin.

Two species have been named from near by, viz. :

Gazella muscatensis—type locality, Muscat; and

Gazella marica—type locality, Najd, Central Arabia, with range given by Lydekker as desert tract from Najd to Western Oman.

Gazella morica is the pale desert form of *G. muscatensis*, which it resembles in size. Both are smaller than *G. arabica* from Aden.

ARABIAN ORYX

Oryx beatrix Gray. Arabic "Wudhaihi."

No specimen.

The type was presented to the British Museum by Captain Sheppard in 1857, who was supposed to have obtained it from the shores of the Persian Gulf. The material in the national collection is scanty, and the donors probably obtained the skins from natives who were not the actual collectors, so localities are not very reliable.

The home of this fast-diminishing species is to-day the uninhabited centre of the Great Arabian Desert, to which they have been driven by the increasing arms among the tribes. The Al Murra tribesmen, who roam as near the centre as any Arabs, say they were plentiful many years ago in the deserts around Jabrin in seasons of good rain, when they followed the growing vegetation. Now they are only to be found far to the south in the Great Desert, more particularly in the neighbourhood of Najran.

A fine specimen sent during the war to H.M. the King by the Sultan of Najd is still alive in the London Zoological Gardens. Najd in this case should not be given as the place of origin, as animals are sent for long distances to the ruling sovereign by the tribes, as presents, and it would be safe to assume that this and all those in the British Museum have had their origin in the South Desert, with the exception of those killed by D. Carruthers in Tebuk in the Northern Nafud.

The Arabian species is the smallest of the *Oryx* group. Lydekker gives shoulder height 35 inches, and horns from 22 to 27 $\frac{1}{4}$ inches in length.

APPENDIX II

BIRDS

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The Birds of Jabrin, Jafura, and Hasa in Central and Eastern Arabia and of Bahrain Island, Persian Gulf. By Dr. C. B. TICEHURST, M.A., M.B.O.U., and Major R. E. CHEESMAN, O.B.E., M.B.O.U.

Corvus corax ruficollis Less. "Ghorab."

The Brown-necked Raven was seen at intervals throughout the country traversed, nearly always in pairs, but on one occasion three and on another four were noticed. Each breeding pair seems to have a beat of twenty miles round its nesting-site or a reservation forty miles across, but at isolated large camps, as at Jabrin oasis, they congregate slightly of necessity for food. A nest with six eggs was found on February 13 in the Jafura desert, situated in a thornless, leafless bush, *Calligonum comosum*, "Aabel," only eight feet high in the trough of high sand-dunes. The parent was put off the nest, but just kept out of shot. Of the eggs, five were normal and the sixth small and olive-brown in colour, measuring 32×23.5 mm.; the others varied from 43 to 50×30 to 31 mm. The inaccessibility and deserted nature of the country are emphasised by the lack of the usual precautions taken by this bird in its choice of nesting-site. Another nest was seen on February 16 at Jabal Aquila, at the top of an acacia, *Acacia flava*, "Salam," twenty feet high. There were probably eggs in the nest, as the bird was put off, but the thorns were too formidable for the Arabs to face a climb. A deserted and empty nest was found on a cliff-ledge at Jabal Zarnuqa.

On several evenings at Hufuf a pair came to roost on tussocks of grass in the desert; probably an acquired habit, as the position is safer than the date-trees of the oasis, where they would be at the mercy of the local sportsmen.

It was surprising to find this the only representative of the

Crow tribe in Hasa, as the date-gardens of Hufuf appeared suitable for the Hooded Crow. The croak is similar to but not so loud as the Common Raven's. It is difficult to see in the field any brown tinge on the neck, and identification would not be easy at a distance in localities where *laurencei* might occur. In the *Geographical Journal* (Nov. 1923) I recorded this Raven as *C. c. laurencii* in error.

(R. E. C.)

Sturnus vulgaris Linn.

Apparently only stragglers reach Hasa in winter, and the Starling cannot be looked on as a regular winter visitor; those that venture as far do not remain and, maybe, return whence they came, to Persia or Iraq. The following are the only records:—three seen at Oqair on November 19 and one there on March 7. Two flocks of about fifty birds passed over Hufuf town on December 8 at dawn, flying south; they were not seen again.

Passer domesticus hufufæ. "Usfür."

C. B. Ticehurst & Cheesman, *Bull. B.O.C.* xlv. 1924, p. 19.

Common and resident at Hufuf, but none seen at Oqair or Jabrin. House-Sparrows, probably the same race, were common on Bahrain. The grey rump and the absence of much marking on the mantle were noticeable characters in the field.

Nine males and five females were obtained at Hufuf, and have recently been described as a new race. They belong to the white-cheeked, small-billed group, and are nearest *indicus*; from the latter they are distinguished by the general paler coloration, the head, rump, and upper tail-coverts in fresh plumage are greyer, very slightly washed with a paler brown and to a less extent than in *indicus*, under-parts purer white, and the mantle has less of the cinnamon markings.

♂. Wing 72-77; bill (base) 13.25-14.5 mm.

♀. Wing 70.5-74; bill (base) 12.5-13.5 mm.

Old males have black bills even in winter. *P. d. buryi* from Southern Arabia (Aden, etc.) seems to be quite indistinguishable from *indicus*. The Hufuf Sparrow evidently has been isolated in the oasis long enough to have become a recognisable race, as might have been expected.

Emberiza calandra Linn.

One Corn-Bunting seen at Oqair in a lucerne patch by a well on November 17 was probably a straggler; it breeds in Iraq.

Alaemon alaudipes cinerea (Zar.). "Umm-al-Salim."

This Lark is resident and generally distributed: if not "common" in the usual sense of the word, it more nearly deserved that title in this wilderness than any other species; indeed, for many miles' march it would be the only bird seen. It would seem to be one of those species which have solved the problem of life without drinking, for it was met with as much as seventy miles away from the nearest well, though it is possible that occasional morning mists and dew observed in the sand-dunes would enable it to take drops of moisture from the bushes; however, it must be able to exist for long periods without drinking, and it was never seen at wells or water-holes, a fact which one of us noted also in the Sind desert.

Four males: wing 132-140; bill (base) 32.5-36.5, from frontal feathers 28-31 mm.

Three females: wing 116-124.5; bill (base) 31-32, from frontal feathers 26-27.5 mm.

These are a trifle longer in bill than Sind birds, but otherwise they match them pretty well; however, bill-length in this species varies very much. They are on the whole greyer than Egyptian birds and considerably larger, though in colour alone single birds can be matched with single birds from Egypt. As I have pointed out before, colour in these Larks is a character which must be used with great caution.

Ammomanes deserti azizi. "Hamra."

C. B. Ticehurst & Cheesman, *Bull. B.O.C.* xlv. 1924, p. 20.

This Desert Lark, which is certain to be resident, was found usually in the debris at the foot of chalky sandstone hills in pairs or small parties, and often associated with *Ammomanes c. pallida*. Cheesman first obtained this Lark at Abu Mahara near Salwa on March 31, 1921—a male about to breed. On his recent trip he found it at Jabal Abu Ghanima (500 feet), near Hufuf, and on Jabal Zarnuqa, while small parties were seen in the waterless marches to Jabrin, but these were probably wanderers from their normal terrain, as usually they were not met with except within reach of water-holes; in fact, the surest way of finding *Ammomanes* is to watch by an isolated well within reach of the foot-hills, as we both previously had noted in the Pusht-i-kuh and Sind. The sandstone rubble debris which these birds particularly affect has a pinkish-white tint exactly resembling the coloration of the birds. The varied colorations

in *Ammomanes* appear to be closely correlated with the colour of the ground they live on, and have nothing to do with the amount of rainfall.

This race is named in honour of Major Cheesman's host—His Highness Abdul Aziz ibn Saud, Sultan of Najd.

Three males, wing 100–105; five females, wing 94–100 mm. Bill as in *isabellina*.

Much paler above than *isabellina*, which is the nearest to it; pale pinkish isabelline above, when worn, creamy-isabelline; below much whiter and the ticking on the throat very dark. Bill lemon-yellow.

An *Ammomanes* of sorts was seen on Bahrain Island.

Ammomanes cinctura pallida Cabanis. "Hamra" (? any brown bird).

What has been said about the last applies pretty well also to this little Desert Lark, as both are often found together. The smaller size of this bird is not very noticeable in the field. It is doubtless resident, and was seen as far south as Jabrin.

Four males, wing 93–97 mm. Bill dark horn above, paler below.

In a series these birds are greyer on the upper parts, tertiaries and secondaries, less sandy-red than in *arenicolor*, and have whiter breasts and flanks less tinged with pale sandy-isabelline; some individual birds cannot, however, be picked out. *A. c. pallida* was described from Qunfuda on the Red Sea (Asir Prov.), and Dr. Stresemann, to whom the Hasa birds were sent, has compared them with the type in the Berlin Museum and he finds them "quite alike."

It appears to me that this small isabelline Desert Lark is clearly a race of *cinctura* and not of the large dark "agricultural" *phænicura*, whose more western and more desert representative perhaps is *zarudnyi*. (C. B. T.)

Alauda arvensis intermedia Swinh.

The Skylark is a winter visitor in quite small numbers. A single bird was obtained seven miles north of Hufuf, feeding with Short-toed Larks on rice-threshing floors; a few were seen at Hufuf on December 22 and January 6 in growing wheat.

Galerida cristata magna Hume. Arabic "Gobar."

The Crested Lark is by no means a common bird in Hasa; six were seen at Oqair on November 17, and in the forty-mile

march to Hufuf only one pair, and that at a halting-place where there is a well. At Hufuf one pair and a flock of eight were all that were seen during the whole winter; at Jabrin (February 19-22) one or two were always round the camp; in long waterless marches it was not met with at all. From the scarcity of this bird at a large oasis like Hufuf one must suppose that it is a winter visitor, as it seems very unlikely that the total Crested Lark population would be five pairs! It is known to be a winter visitor to Lower Sind.

Six males: wing 109.5-113; bill (base) 20-22, from frontal feathers 17-18.5 mm.

This series match birds from Quetta very well; *G. c. magna* varies a little in colour, some being greyer, some sandier than others.

These Hasa birds are easily distinguishable from *tardinata*, which has a browner mantle with darker centres to the feathers, less white under-parts, and is smaller.

Five males, S. Arabia: wing 102-106.5; bill (base) 19.5-20.5 mm.

Five females, ,, wing 96.5-98.5; bill (base) 17.5-20 mm.

On Bahrain Island Crested Larks were common in March, but unfortunately no specimens were obtained.

Calandrella rufescens minor (Cabanis).

Large flocks of Short-toed Larks were met with in the vicinity of Hufuf wherever there were rice-threshing floors, and they came regularly to drink at pools of spill-water from irrigation. A flock was met with in the waterless desert between Hufuf and Jabrin, but these birds were apparently only passing through or touring.

Two males: wing 92-94; bill (base) 11 mm.

Two females: wing 90.5-92; bill 11 mm.

These four birds are so near *minor* that I certainly should not separate them, though they seem a trifle paler perhaps on the upper parts; they are certainly neither *seebohmi* nor *heinei*. They are probably winter visitors.

Calandrella rufescens persica (Sharpe).

Mixed with the last-named in the same flocks and feeding on the rice were numbers of this larger race, which must, I think, be *persica*, though I have seen no specimens in exactly the same dress. (C. B. T.)

One of the most plentiful birds in Hasa oasis, it was met with at Oqair on November 18 and at Jabrin on February 23; probably a winter visitor.

Three males: wing 99-106; bill (base) 12.5-13 mm.

Three females: wing 94-97; bill (base) 12-13.5 mm.

Bill lemon, legs horn-brown.

Motacilla alba dukhunensis Sykes.

The White Wagtail is a winter visitor to the Hasa oasis, and is plentiful everywhere in flocks in lucerne fields and growing wheat. Every evening they flighted in flocks over Hasa town to roost on the plains to the north. Not seen at Jabrin. Plentiful at Oqair on March 6 and several there on the 29th, while at the Salwa wells several, doubtless halting migrants, were seen on April 5. A starved bird was caught at sea off Jabal Hawaith, Salwa, on April 1, 1921.

Motacilla cinerea Tunstall.

A single Grey Wagtail wintered in Hufuf oasis, and was seen feeding about the same spring on many occasions from December 4 onwards. One at Oqair, probably on passage, on March 29, 1921.

Motacilla flava Linn.

Motacilla feldegg Michah.

Yellow Wagtails are passage migrants through Hasa. A Hufuf garden-owner informed Cheesman that "Hufuf is invaded by little bright yellow birds that live in the skies and descend at certain seasons to the lucerne fields!" The fore-runners of this invasion were seen on March 7 in two male *M. feldegg* in a lucerne field at Oqair. The spring arrival of Yellow Wagtails in the East is a remarkable sight which we have witnessed in Iraq and Sind—lucerne fields which held not a bird one day may be yellow with males, and males only, the next morning. The earliest date in Iraq is March 13. Blue-headed Wagtails were met with on passage at Salwa at the end of March 1921, and at Oqair on September 26, 1920.

Anthus pratensis (Linn.).

A Meadow-Pipit was seen at Oqair on November 11.

Anthus cervinus (Pall.).

The Red-throated Pipit is a winter visitor in small numbers to the irrigated fields of Hufuf oasis, associating and fighting to roost with White Wagtails. A few were seen at Oqair in November, and one was obtained at Salwa on April 2, 1921.

Anthus campestris (Linn.).

A Tawny Pipit was seen at Oqair on November 17, and two at Salwa on April 1, 1921. Perhaps a passage migrant.

Anthus spinoletta coutellii Savigny.

The Water-Pipit is a not very plentiful winter visitor to Hufuf oasis, feeding in the irrigated wheat-fields, and flying over the town with the Wagtails each evening to roost. Two obtained, and these match the Egyptian birds better than *blakistoni*. Breeds in Persia.

Lanius excubitor aucheri Bp. Arabic "Srad," Badawin "Serati."

The Great Grey Shrike is not common, but probably resident; a pair were seen south of Jabrin on February 20. The organs of the male were in breeding condition. One seen in the Jafura Desert on February 13. Breeds on Tanb Island in the Persian Gulf. The male obtained is typical *aucheri*.

Pycnonotus leucotis mesopotamiæ Tice.

The White-eared Bulbul is plentiful, but only in the date-palm area of Hufuf oasis; it does not occur at Jabrin, so Hufuf is probably the southern limit. Bulbuls were seen also in the date groves on Bahrain Island. This is the "game bird" of Hufuf to the local sportsmen! Four were obtained, and all have the yellow eye-rim of the Iraq bird, and are larger and greyer below than the Indian race. It is very interesting to find the Iraq Bulbul at this oasis; its distribution east of Fao is not known, but the possibility of its having been introduced into Hufuf and Bahrain from Basra must not be lost sight of.

Sylvia nana nana (H. & E.). Badawin "Shawaila."

The Desert Warbler is the commonest species seen at Jabrin, frequenting bushy areas. Cheesman thought that on February 20 these birds were pairing, and were resident there. However, I do not think this can be taken as a fact, since the birds obtained are in moult and therefore the breeding season must

have been some distance off; moreover, the organs were not enlarged, except to a slight extent in one male. A few were seen at Jabal Arba, but not so plentifully as at Jabrin. Cheesman says the warning note or song is very like a miniature of the English Partridge's.

Five obtained, all more or less in moult; the upper parts have perhaps a slightly greyer tone than birds from India at the same time of year, but individuals cannot be picked out, and as these birds are moulting and therefore showing two states of plumage, the worn and the fresh, we do not think too much stress can be laid on the greyer tone. The measurements and soft parts are the same as in Indian birds.

Sylvia mystacea (Ménét.).

As a belated migrant Ménétries' Warbler was seen on November 19, between Oqair and Jisha. Breeds in Iraq and Persia.

Acrocephalus schænobænus (Linn.).

A female Sedge-Warbler, doubtless on passage, was secured in some rushes by the sea at Oqair on March 29, 1921.

Acrocephalus arundinaceus zarudnyi Hart.

A Great Reed-Warbler was obtained by Sir Percy Cox at Oqair on December 1, 1922.

Luscinola melanopogon mimica Mad.

Almost the only inhabitants of a reed-bed of about two square miles, situated at Umm al Saba, seven miles north of Hufuf, were a pair of Moustached Sedge-Warblers. The male (secured) was in full song, and the other was doubtless the female; the sexual organs were up to breeding size, and there can be no doubt that this pair were actually breeding there. The song resembles a mixture of the songs of the Common Whitethroat and Sedge-Warbler, but is sweeter and has better notes than either. The bird seldom keeps to one theme for more than two or three seconds, and sings continually while clinging to a reed-stem, and is difficult to see. No more were met with anywhere in the oasis.

This Sedge-Warbler was very familiar to me in Sind during the cold weather, and I certainly never heard it singing, nor were the organs of any I obtained there enlarged. Cheesman brought the body of this bird home in spirit, and I found the

testes even then as large as peas. Captain Buxton was certain that this species was breeding in July near Amara, in Iraq; Blanford found it breeding at Shiraz; so that the fact of it breeding in Northern Arabia is not very remarkable, but the month seems an odd one; possibly the reed-bed is too dry later on. The specimen brought back is no doubt *mimica*.
(C. B. T.)

Locustella naevia straminea Seebh.

A male Grasshopper-Warbler was secured in rushes by the sea at Oqair on March 29, 1921; doubtless a passage migrant.

Prinia gracilis hufufæ C. B. Ticehurst & Cheesman, *Bull. B.O.C.* xlv. 1924, p. 19.

The Streaked Wren-Warbler was one of the few common birds in Hufuf oasis, frequenting the date gardens, and was seen at no other place on the mainland, though a Streaked Wren-Warbler was common in similar places on Bahrain Island, but no specimens were obtained there. Several males were in full song on January 11, and their organs indicated that the nesting-season was approaching. A few inhabited the big reed-bed at Umm al Saba near Hufuf.

Eight males: wing 44-48; tail 60-68 mm.

Four females: wing 44-47; tail 61-65 mm.

From *palestinæ*, *iraquensis*, *lepida*, *carlo*, and *gracilis* this race is at once distinguished by the larger and blacker, sharply cut, subterminal band on the tail-feathers; it is paler and greyer above, with paler rufous wing-edges, and purer white below than *yemenensis*; greyer above, whiter below, and more finely streaked on the mantle than *deltæ*; with a much shorter bill than in *natronensis*. The tail-feathers appear to be broader than in all these races.

Phylloscopus collybita abietinus (Nilss.).

The Chiffchaff is a winter visitor in small numbers; not more than three or four were noticed during the winter in Hufuf; six were seen during the forty-mile march from Oqair to Jisha on November 19. At Oqair on March 6 it was plentiful on passage; and it was noted too at Salwa on April 5, 1921. Two obtained are clearly this race.

Monticola saxatilis (Linn.).

One of the first heralds of spring migration northward, a male Rock-Thrush was seen on a wall at Hufuf on March 3,

the only one met with. The earliest record in Iraq is March 30.

Monticola solitarius (P. L. S. Müller).

A Blue Rock-Thrush was seen at Oqair on November 17, the only record. Status doubtful, probably a winter visitor.

Phenicurus ochrurus phenicuroides (Moore).

One at Hufuf on January 11, and another seen in South Hasa on March 1, are the only records of the Black Redstart. Winter visitors in small numbers. Breeds in Persia.

Saxicola torquata (Linn.).

The Stonechat was seen at Hufuf on January 28, and another at South Jabrin on February 18. Winter visitor in small numbers. Noted on passage at Salwa on April 5, 1921.

Ænanthe ænanthe (Linn.).

Several Wheatears were seen at Bahrain Island on March 27, and at Oqair on March 29, 1921. Evidently on passage.

Ænanthe deserti oreophila (Oberh.).

Ænanthe deserti atrogularis (Blyth). Badawin "Daigin," or "Abu Zarā."

The Desert Wheatear is by far the most plentiful of its tribe in the Hasa and Jabrin deserts, and males far outnumbered females, which fact one of us had already noted in the Sind Desert. Two specimens obtained belong to the race *oreophila*, the rest are *atrogularis*. The series shows beautifully the seasonal change which takes place in the loss of the rufescence on the upper parts and of the white on the throat, till in March the bird has greyish upper parts and a black throat. Breeding in Tibet, *oreophila* has a comparatively narrow zone of distribution in winter—E. Persia and Beluchistan, N.E. Arabia to Socotra.

Ænanthe isabellina (Cretz.).

Cheesman thought that the Isabelline Wheatear was a passage migrant, as he saw none till February 20, and several were subsequently seen and three obtained. The organs of one on February 28 showed the approach of the breeding-season. One was seen at Oqair on November 18. Status uncertain; probably a passage migrant.

Ænanthe leucomela leucomela (Pall.).

The Pied Wheatear is evidently a passage migrant; the first was seen on February 22 at Jabrin, and it became plentiful during the next week. Several were seen on passage on Bahrain Island on March 27, and at Salwa on April 5, 1921. In Iraq the first arrivals were noted on March 1.

Ænanthe monacha (Temm.).

A female of the Hooded Wheatear was secured on Jabal Dukhan, Bahrain Island, on March 26, 1921. Status unknown; it seems to be rare everywhere, and no doubt resident where it occurs.

Ænanthe xanthopyrmyna chrysopygia (De Fil.). Arabic "Umm-al-henna" = "mother of henna."

The Red-tailed Wheatear is rather a rare winter visitor; a few were found inhabiting the sandstone hills of Jabal Abu Ghanima (500 feet above sea, 300 feet above plain) in January, and in a similar situation in Jabrin on February 20. Three obtained belong to this race, which breeds in Northern Persia from 5000 to 12,000 feet.

Hirundo rustica rustica Linn.

Swallows in very small numbers were noted up till December 5, after which date none was seen until February 1, when three were met with at Hufuf travelling north. On the march from Hufuf to Jabrin across the desert on February 13, and again on the return journey on February 25, single Swallows appeared, and after snapping up a few flies almost off the camels' noses disappeared into space again. On March 27, 1921, Swallows were common on Bahrain Island, and were about to breed there. Noted on passage at Salwa on April 1-3, 1921. In Lower Iraq, too, Swallows are only absent during December and January.

Delichon urbica (Linn.).

Two House-Martins were seen on Bahrain Island on March 25, 1921; they were passage migrants.

Ptyonoprogne rupestris (Scop.).

A solitary Crag-Martin was seen over Hufuf town on January 1. Several were seen, and one obtained during a marked passage northward up the Salwa coast on March 31, 1921, and one was seen on Bahrain on March 27, 1921.

Odd birds apparently winter, the bulk being passage migrants. This Crag-Martin has quite a different "chirrup" from the paler *P. obsoleta*, which "chortles"; it also has a more tired flight, rising languidly upwards and falling again like a belated Swallow left behind in autumn, and too weak to face migration.

Ptyonoprogne obsoleta obsoleta (Cab.).

The Pallid Crag-Martin was common at Hufuf, but not seen at Jabrin. Many birds frequented the town during the day, hawking over the bazaar, which even in winter supported a multitude of flies. They breed in the cliffs of the sandstone hills in the vicinity, and old nests were found which were being utilised at night for roosting purposes. The nests, which were not built in colonies, were open at the top like that of a Swallow, and were placed for protection under ledges which overhung them. They were composed of the usual mud pellets, and lined with grasses and Jerboa hair, probably filched from old pellets of the Desert Eagle-Owl, which had a perch below. These Crag-Martins are very frightened of rain, and at the first few drops of the rare small showers they all dashed for the mud walls of the forts, where they clustered together in thirties and forties, waiting till the shower ceased. A furious fight was witnessed between two birds high up in the air; several times in attacking they clung together viciously, falling thirty to forty feet ere they let go. The note of this bird is a typical Martin-like chortle.

Four males, wing 117-122; four females, wing 119-124 mm.

This is a fine series in good plumage. When compared with a series at the same time of year (November and December) from Egypt (Mokottam Hills), the Hufuf birds are not really paler, though odd ones may be when matched with single birds, and therefore I keep these Arabian birds under the typical race; *P. o. reichenowi* from Sinai and Suez is surely the same also. I have seen none thence, but Palestine birds seem to be typical. These Crag-Martins vary a good deal and considerably so seasonally; this series from Hufuf and those from Egypt are considerably paler than Sind birds, though Sind winter birds match pretty well Egyptian ones obtained in May. The Sind-Beluchistan bird must stand as *pallida*, notwithstanding the fact that it is darker. (C. B. T.)

The typical race has been taken at Fao as a wanderer, and in South-western Persia.

Riparia riparia (Linn.).

Odd Sand-Martins were seen up to December 1—belated passage migrants; no more were seen, but in 1921 three flocks were met with on Bahrain Island on March 27, at Oqair on the 29th, and near Salwa on April 3. In Lower Iraq (Fao) also, this species is only absent during the mid-winter months.

Micropus murinus murinus (Brehm.).

A few Pallid Swifts apparently spend the winter in Hasa; six were seen hawking over Hufuf town on January 1, the first seen, and ten were seen at Umm al Saba, near Hufuf, on the 28th. By February 8 the numbers had increased and birds were seen on most evenings over Hufuf. On April 1, 1921, several parties were seen flying north up the coast at Salwa, and one was obtained.

Caprimulgus europæus sarudnyi Hart.

This Nightjar was not obtained in Hasa, but one was seen on board the steamer in the Arabian Sea between Mukalla and Ras Fartak, Hadhramaut, three miles from the coast on October 26, 1923; by a curious coincidence one was caught in the same position thirty miles off Ras Fartak on April 12, 1924. This bird is just a shade paler than the typical race and has the white spot on the outer web of the second primary. It is rather suggestive that Ras Fartak is on a line of migration from Arabia to Africa; southward of this point birds would strike Africa at its north-east point in Somaliland. The earliest record in Iraq (Fao) is April 7.

Merops apiaster Linn.

A Bee-eater was seen on passage at Oqair on March 31, 1921. It arrives in Iraq at the end of March, and breeds in South-western Persia.

Merops persicus persicus Pall.

The Persian Bee-eater was noted at Bahrain Island on April 10, 1921; it arrives in Iraq about middle to end of March, and breeds.

Upupa epops epops Linn. "Hudhud."

The Hoopoe does not winter in Hasa; the first was seen on March 1 at Dalaiqiya, flying north, travelling swiftly, about a foot over the desert, evidently a leader of the spring migration.

Three were seen at Oqair on the 7th, where in 1921 some were still on passage on March 29. In Iraq the earliest arrivals were seen at Zobeir on February 28. Breeds on the Persian Plateau.

Alcedo atthis pallasii Rchb.

The Kingfisher is not uncommon along running streams in the Hufuf oasis, where it is very tame. The little fish *Cyprinodon dispar* is very numerous in these streams flowing from springs, and would provide ample food. No doubt a winter visitor; one obtained belongs to this widely distributed race.

Bubo bubo desertorum Erl. "Fayum."

These Eagle-Owls live in the crags and caverns of the sandstone hog's-back hills that are scattered about the desert round Hufuf oasis. Round Jabrin there are similar suitable caves, but no Owls could be located there. The hills occupied by the birds are strewn with pellets in all suitable crannies; the pellets contained remains of Jerboas, Bats, *Ammomanes*, Scarab Beetles and Scorpions. The white sandstone when weathered becomes pinkish and nearly matches the colour-tones of the Owls, as it does the colour of the *Ammomanes*: if in the latter case one supposes that it is a matter of colour protection, in that of the Owls it must surely be camouflage, as the Owls can hardly have any enemies to be protected from. Yet Cheesman found them very difficult to approach; they generally sit at the mouth of some cave and can be detected with field-glasses, asleep but watchful, with ear-tufts erect. On being disturbed, they leave the hills which offer cover for near approach, and settle out in the flat desert, where no nearer approach than a hundred yards is possible, and that only by crawling.

Two pairs were obtained: ♂ w. 367, ♀ w. 368; ♂ w. 343, ♀ w. 402 mm. Judging by the organs, the breeding-season should be in February. As a series these four are fairly uniform; in one pair the male is slightly paler, in the other pair slightly darker than his mate.

This is the palest form of Desert Eagle-Owl and matches exactly those obtained on the Angus Buchanan Sahara expedition in the Air (Asben) district, S. Sahara, and practically matches two birds in the British Museum from Shendi (Nubia) and Darragh (Sudan). We thus have two forms—an absolute desert bird, very pale, extending right across desert Africa into Arabia, and according to Dr. Hartert to Palmyra in Syria, and a darker form in Algeria and Tunisia, etc. For a discussion

on these races see *Novitates Zool.* xxxi. 1924, pp. 16-17. I have followed Dr. Hartert in using *desertorum* for the pale race—an apt name enough, but unfortunately Erlanger's type came from a somewhat intermediate area.

Tyto alba alba (Scop.). “Umm-al-Sakr” (mother of rock).

The screech of the Barn-Owl was heard on several occasions in Hufuf, but no birds were ever seen, though Cheesman heard of one having been shot to feed the Governor's falcons. Pellets were found in a ruined castle at Jabrin oasis, which from the size were attributed to this Owl. Several pairs are resident on Bahrain Island, and an old nest was found in a tomb on March 27, and a bird obtained. This, a male (wing 287 mm.), is pale above and white unspotted below, and can be matched by many European examples.

Gyps fulvus (Habl.).

Two Griffon Vultures were seen round camel carcasses on the caravan route from Oqair to Hufuf on November 19.

Neophron percnopterus.

The Egyptian Vulture is resident in small numbers: one seen on Jabal Abu Ghanima, Hufuf, on January 19, and a pair at their nest on the ledge of a high cliff in Jabal Arba, Hasa, on March 1.

Circus macrourus (Gm.).

The Pallid Harrier is a scarce winter visitor; single birds were noted at Hufuf on November 21 and December 29, and at Jabrin on February 20. A pair at Oqair on March 29, 1921, and at Salwa oasis on April 4. A male was caught at sea, thirty miles off the Hadhramaut coast, on April 11, 1924.

Buteo vulpinus (Gloger) (= *desertorum* auct.).

A nest of a Buzzard with three young was found on Jabal Kharma Zarnuqa on February 29; one of these was kept alive till March 23 with a view to identification of the species. The nest was on the ledge of a cliff forty feet from the ground and built of sticks; the ledge was just wide enough to crawl along. The young had been fed on dismembered Gerbils (*Meriones* sp.), and a fresh-caught one was in the nest. The parent birds were seen, but kept at too high an altitude for identification.

The feathering young has the cere and legs pale yellow, iris brown, and would pass as this species.

Aquila sp.?

An Eagle with almost black plumage was seen at Jabrin on February 17; it chased a Hare which had been moved into the open, and made several stoops, but being somewhat baffled by human proximity it missed each time, and the Hare escaped down a burrow.

Accipiter nisus (Linn.).

A male Sparrow-Hawk was seen over Hufuf town on November 26 and subsequently, and on one occasion with a female. One seen at Bahrain on April 10, 1921. Doubtless winter visitors.

Milvus migrans migrans (Bodd.). Arabic "Hadayiya."

A Black Kite was obtained at Zarnuqa on February 28, when a pair came over the camp; one was seen on March 3 at Hufuf. One was noted at Bahrain Island on March 27, 1921. All these were doubtless on passage to their breeding-grounds in Persia. The badawin informed Cheesman that these Kites do not breed in Hasa.

Falco peregrinus Tunst. Arabic "Shahin."

The only wild Falcon was seen at Oqair on March 29, 1921. The Governor of Hufuf had about thirty trained falcons—Peregrines and Sakirs—which were all bought from dealers. Two such merchants travelled on the steamer from Basra in November, bound for Persian Gulf ports, and had with them fifty falcons of both species. They were mostly birds of the year, and were valued at from £10 to £20 each. The Peregrines were said to have come from Zobeir and the Sakirs from Baghdad; the Arabic for the latter is "Hurr."

Falco aesalon pallidus (Sushkin).

A Merlin was obtained at Ain al Najm, near Hufuf, on February 1; another was seen at Zarnuqa on February 11, and one near Jabrin on the 21st. Probably a winter visitor. The one obtained is an exceedingly pale bird, many shades paler than *insignis*, which again is distinctly paler than the typical form.

Falco tinnunculus Linn.

A Kestrel was seen over Hufuf on January 21; one at Jabrin on February 20, and one at Salwa on April 5, 1921. Perhaps the typical form wintering.

Phalacrocorax carbo sinensis (Shaw & Nodder). Arabic "Logha."

Many Cormorants were seen on the reefs and small islands near Bahrain in company with the smaller Socotra Cormorant.

Phalacrocorax nigrogularis O.-Grant & Forbes.

The Socotra Cormorant was very often seen resting on the reefs and rocky islets between Bahrain Island and Salwa. It is easily distinguished from the Common Cormorant by its smaller size. A large flock of many thousands passed down the coast off Ras Sufaira, south of Oqair, on March 30, 1921. The leading birds plunge into the water to fish, and on emerging join the rear-guard, so that the progress of the flock is continuous. An immense cloud of these birds were in Bahrain Harbour on March 11. It is resident, of course, breeding on many islands in the Gulf.

Anas sp. ?

Six Ducks, about the size of Shovellers, were seen flying round the date gardens at Hufuf, and furnish the only record for the oasis in five months, November to early March. The extensive reed-beds and shallow flood-land seem ideal for Duck, yet they are absent, and the explanation probably is that the floods, being spill-water from irrigation, are highly charged with saline matter which thickly encrusts the bottom and stems of reeds, and so probably checks delicate water-weeds and animal life. The running streams of fresh water pass through gardens crowded with gardeners at work.

Querquedula crecca crecca (L.).

Nine Teal were observed on some flood-water at Hufuf on December 28; on being disturbed they departed, to be seen no more.

Phœnicopterus ruber antiquorum Temm.

Flamingoes were seen at Oqair on November 17 and March 6, and near Salwa on April 10, 1921. A non-breeding visitor to the district, but breeding at the head of the Persian Gulf.

Ardea purpurea Linn.

A Purple Heron was seen on Bahrain, March 27, 1921. A wanderer.

Nycticorax nycticorax nycticorax (Linn.).

The familiar "squark" of the Night-Heron was heard on the night of December 14, as the birds passed over. Like the Ducks, they probably found the locality unsuited to them, and they departed whence they came. It breeds in Iraq.

Demigretta sacra asha (Sykes).

The Reef-Heron was seen on the shore at Oqair on November 17. It breeds on the Gulf.

Chlamydotis undulata macqueeni (Gray). Arabic "Houbara."

The Houbara was not actually seen, but evidence goes to prove that in rainy years they may be plentiful; like true nomads, they follow the vegetation. Fresh footmarks were seen in the sands of Jafura desert on February 14, and again at Jabrin on the 21st. Three eggs taken on February 14 between Hufuf and Riyadh were given to Cheesman. Mr. Philby found a nest of four eggs on April 10, 1918, near Shauki, between Hafal-al-Batin and Riyadh.

Burhinus œdicnemus astutus Hart. "Burhan."

Three Norfolk Plovers were seen and two obtained in the Jafura desert on February 27. Footprints seen in the Wadi Sahba on the 25th. These birds were easily approached on camels by waving a white shirt at the end of a camel-stick, when they immediately squatted! Both these birds are typical *astutus*, and were doubtless resident. One was shot at Salwa on April 4, 1921, as it came to drink at the well; this is a much more rufous bird and matches well *saharæ*. This latter race is by no means satisfactory; it is found in North Africa as a breeding bird where *astutus* does not occur, and yet in Iraq, Central Arabia, and Beluchistan there occur birds (records August to April) which I cannot differentiate from *saharæ*, and they are in the breeding area of *astutus*. They can hardly be migrants. (C. B. T.)

Cursorius cursor (Lath.).

Three Coursers seen in the desert near Hufuf on December 31 were the only ones met with.

Capella gallinago (Linn.).

Two Snipe were flushed at Umm al Saba, near Hufuf, on January 6. These were in the huge reed-bed two miles long

by one mile broad. This reed-bed was a most disappointing place for birds: it is covered with tall reeds and rushes and has open spaces of water nowhere more than two to three feet deep, and not a sound of bird-life breaks the stillness. A whole day was spent by Cheesman and his servant wading through it and beating it out for birds, and beyond the Snipe, one Teal, one Black Partridge, a pair of Moustached Sedge-Warblers, and a Wren-Warbler there was nothing to be found! Like other waters, it is probably too saline.

Erolia minuta (Leisler).

A flock of Little Stints were seen on the edge of a flooded depression at Hufuf for several weeks during the winter.

Tringa totanus (Linn.).

A Redshank was seen at Hufuf on December 29; the call was first heard high up in the sky to the north, and the bird descended and settled on the edge of shallow flood-water, but after a moment departed again to the north. Noted on Bahrain Island on March 27, 1921.

Tringa ochropus Linn.

A Green Sandpiper was seen at Umm al Saba on January 28.

Limosa lapponica lapponica (Linn.).

The Bartailed Godwit was seen at Oqair on November 17, and one was obtained there in breeding dress on March 29, 1921.

Charadrius alexandrinus alexandrinus Linn.

A flock of one hundred Kentish Plover were seen resting near flooded land at Hufuf on December 17, where they only remained a few days. Resident on the coast; a nest with three eggs was found at Oqair on March 29, 1921, and this species was seen at Bahrain Island on April 10.

Charadrius leschenaultii Less.

Several Sand-Plovers were seen on the sandy plain above high-water mark at Oqair on November 17.

Larus genei Brème (= *gelastes* auct.).

Slender-billed Gulls were seen on the Salwa coast on April 10, 1921. Breeds on the Persian Gulf.

Sterna (Hydroprogne) caspia caspia (Pall.).

Caspian Terns were seen in Bahrain Harbour on March 27, 1921. Breeds on the Persian Gulf.

Sterna albifrons saundersi Hume.

A pair of Saunders' Tern were seen and one secured on Bahrain Island, April 11, 1921. One was caught exhausted off the Hadhramaut coast on May 8, 1923. Very likely this race breeds at the southern end of the Persian Gulf; at the northern end the breeding bird is *S. a. albifrons*.

Podiceps cristatus cristatus (Linn.).

A Great Crested Grebe in breeding dress was found dead on the beach at Oqair on April 1, 1921. It is known as a winter visitor to the Gulf and Mekran coasts and breeds in Iraq.

Fulica atra Linn.

A Coot was seen on an open lake of spill-water in Hufuf on December 15. It was not there next day and was not seen again.

Columba livia Gm.

A flock of twenty Rock-Doves were seen on a hill near Jabrin on February 21, but would not allow approach nearer than half a mile. It is evidently resident in quite small numbers; a deserted nest in which young had been reared the previous year was found in a ruined castle at Jabrin oasis, and a roosting-place in a dry well. None were seen elsewhere and, unlike most eastern towns, Hufuf does not support a semi-tame horde of pigeons. It was unfortunate that no specimens could be secured.

Pterocles senegallus (Linn.). Arabic "Ghatta."

From time to time small flocks of this Sand-grouse were met with in the desert round Hufuf and Jabrin, and on one occasion several flocks were seen watering at Hufuf. They are evidently not very abundant, though very likely more numerous in years of exceptional rain. The Arabs say that animals and birds follow the rains from district to district since life depends on vegetation, and this is no doubt quite true in the case of Houbara, Sand-grouse, and Gazelle.

Two males were obtained at Hufuf on March 1. Spotted

Sand-grouse vary considerably *inter se*, and slight differences can be seen between these two and a series from India; however, as I have already pointed out, birds from North Africa vary so, and some are really not distinguishable from Indian ones, that at present I prefer not to separate any races.

(C. B. T.)

Francolinus francolinus (Linn.). Badawin "Warāra."

A male Black Partridge was flushed in the reed-beds of Umm al Saba, near Hufuf, on January 6. This was the only one seen in the Hasa oasis in spite of diligent search and several expeditions to look for it. The local people seemed to know little of it, but gave it the above name when the bird was actually flushed at their feet. It is probably nearly extinct owing to the prowling garden workers armed with fowling-pieces, who shoot anything from a Bulbul upwards! No foot-marks in the sand or mud by the reed-bed could be found, so that there cannot be many there.

I think that there can be now no doubt that the suggestion that the "Grey Partridge" met with by Mr. Philby in Central Arabia (*Bombay Nat. Hist. Soc. Journ.* xxviii. p. 205) was *F. pondocerianus* is incorrect. It was understood then that Mr. Philby was certain the birds were *not* See-see, but further inquiries tend to show that they were. The See-see does not appear to be found in the Hasa and Jabrin hills. (C. B. T.)

Struthio camelus syriacus Rothsch.

The Ostrich was once to be seen in the deserts round Jabrin. The Al Murra tribesman who acted as guide said his grandfather was the last man to kill one there. The improvement in weapons used by the tribes in the last two generations has probably been the cause of the disappearance of the Ostrich in this district; according to native report they are still to be found in the Great South Desert near Najran. See also *Ibis*, 1923, p. 208.

APPENDIX III

REPTILIA AND BATRACHIA

FROM HASA, JAFURA, AND JABRIN IN EASTERN AND CENTRAL ARABIA

Collected by Major R. E. Cheesman in 1923-1924 and presented to the British Museum

Mr. H. W. Parker of the British Museum (Natural History) has identified the specimens, and their approximate distribution is indicated by him by letters referring to the first paragraph. His remarks have been included in the field notes.—R. E. C.

All the specimens collected belong to previously-known species. Twenty-three Lizards representing ten species, a single Frog, but no Snakes, are present. Of these species, some are confined to Arabia (*a*), some extend only northwards into Persia and N. India (*b*), others only westwards into Egypt and N. Africa (*c*), and others again both northwards and westwards (*d*).—W. H. P.

LACERTILIA

GECKONIDÆ

1. *Ptyodactylus lobatus* Geoffroy (*c*). January 19.

2150. Two half-grown specimens from Jabal Abu Ghanima, Hufuf, in bad condition, but apparently agreeing closely with the typical Arabian form. A desert Gecko inhabiting crevices in sandstone hills. Has large circular discs or lobes at end of the toes. This digital expansion is here at the extremity of the digits. Use: for adhesive purposes. The only method of securing them was by shooting with the .410 collecting gun; the cartridges were emptied, half the powder reloaded, the wad replaced, and the rest filled up with fine sand instead of shot.

2. *Hemidactylus persicus* Anderson (*b*). November 26: Hufuf.

5041. Two specimens, ♂ and ♀, from Hufuf town. This species has not been previously recorded in Arabia south of

Mesopotamia. Arabic: "Purse" or "Thator." A house Gecko. In the roof-beams of Hufuf houses. They are not very active now, but come out most evenings. They are almost a transparent white in colour. Digital expansion for adhesive purposes, at the base of digits, the terminal phalanges not being expanded.

AGAMIDÆ

3. *Agama flavimaculata* Rüppel (c). February 2 and 24.

5170. ♀, Jabal Aqula, Jabrin.

5209. Two specimens, ♂, Jabrin.

Only found on gravel plains. They remain motionless, depending on mimicry for protection, as they resemble very exactly their environment in colours and shading. Once disturbed, they dash off, tail in air, and can run as fast as a man. These *Agamas* did not seem to have any holes to run to. They bite hard if they can get their gargoye-like face round your finger. Fingers and toes not fringed.

4. *Phrynocephalus maculatus* Anderson (b). February 16 and 20.

♂, Salwa Bay.

5171. ♀, Jabal Aqula, Jabrin.

5178. ♀, S. Jabrin.

Not previously known from Arabia. These were mistaken by me for *Agamas*, which they resemble in the distance; they also run like them. They do not appear to go to earth when pursued. Fingers and toes not fringed. Habitat, gravel plains.

5. *Phrynocephalus arabicus* Anderson (a). February 26.

Half-grown, Salwa Bay.

5211. 1 ♂, 2 ♀, Jafura.

Seen only on loose sand-dunes and not on hard gravel. They are found in the scanty shelter afforded by desert bushes and when disturbed run out on to the open sand. After going about ten yards they stop and kick with the hind-legs, working the body into the loose sand. The head, still erect, is left exposed. When all is hidden, down goes the head and disappearance is complete. Each specimen went through exactly the same performance. Here the lateral scales of the digits are much enlarged, forming a serrated fringe on either side. This increases the plantar and palmar surfaces and is an adaptation to walking on the loose sand which is their habitat.

6. *Uromastix microlepis* Blanford (*b*). January 4.

5117. Hufuf (dried specimen).

Arabic "Thub." Spiny-tailed Lizard. Eaten by badawin or brought into towns alive for sale. This specimen was bought in Hufuf market for 30 tawila (sixpence). The body cavity contained two apparently distinct intestines, crammed with green shoots of desert shrubs finely masticated into short lengths. This appearance is due to an enormous enlargement of the first part of the large intestine. This enlargement is probably an adaptation to vegetable food. Cellulose is not dissolved by any vertebrate gastric ferment, and until cellulose is dissolved the cell-contents of food-plants cannot be digested. Bacterial fermentation is essential to remove the cellulose, hence the divided stomach of sheep, etc., providing one compartment for bacterial fermentation and one for commencement of digestive processes.

We saw several on the way to Jabrin in February. They live in large, self-dug holes as big as a rabbit's earth, sometimes with two entrances—generally one—and always in firm, stony ground. When surprised too far from the hole to escape, they squat and lie still; at other times they make all speed for home, and the badawin drop from their camels and give chase and can run a little faster than the lizard. They bite hard and can give a sharp rap with the powerful, spiny tail.

It is said that South American Iguanas taste like chicken. No such recommendation attaches to their Arabian kinsman.

LACERTIDÆ. Arabic "Damus" = all Lizards.

7. *Acanthodactylus boskianus asper* Audouin (*c*). February 20.

5178. ♂ and half-grown, S. Jabrin.

5167. Half-grown, Jafura. This specimen shows the sub-ocular shield bordering the mouth as in *A. boskianus euphraticus* Boulenger, but in all other characters it agrees with *asper*. Badawin "Khusawi." These are long-tailed and fleet of foot and belong to the true Lizards. They live in holes among the roots of desert bushes growing in loose sand. The bushes are isolated and scattered at distances of about twenty yards. The Lizards are often found at some distance from their home, and exciting chases took place from bush to bush before these specimens were secured. Has the strongly fringed digits and sandy habitat.

8. *Acanthodactylus cantoris* Gthr. (*b*). March 1921.

883. Two specimens, Salwa. Lizards with long fringes to toes.

Determined by Miss J. B. Procter.

9. *Acanthodactylus scutellatus* forma typ. Dum. and Bibr. (*c*).
February 23—among sand-dunes.

5209. ♀, Jabrin. In the size of the dorsal scales this specimen tends to resemble *A. fraseri* Boulenger from Lower Mesopotamia. *A. scutellatus* has not hitherto been recorded further east than Basra. Another of the true Lizards, very similar in the distance to the above and with the same habits and the strongly fringed digits.

10. *Eremias brevirostris* Blanf. (*b*). March 1921.

882 and 884. Oqair and Salwa. A Lizard with spots, plentiful, and runs fast.

Determined by Miss J. B. Procter.

SCINCIDÆ

11. *Mabuia septemtaeniata* Reuss (*d*). December 16.

5080. ♀, Hufuf.

Plentiful in Hufuf palm gardens. This is the well-known horizontally-striped Skink. The skin is smooth and shiny, and the tail is short and thick. In Hufuf on March 4 we went for several miles past palm-trees growing along the path at distances of 100 yards. On the base of each trunk was one of these Skinks, basking in the sun. Not seen outside the garden area. This species has no digital fringes.

12. *Scincus mitranus* Anderson (*a*). February 11, 15 and 26.

5168. Ad. Wadi Sahba.

5158. Ad. Zarnuqa, Hasa.

5212. Ad. Jafura.

I did not see this species in the open; a remarkable Skink from the sand-dune desert only. A flat upper lip gives a wedge shape to the head, adapted for diving head-first into the sand. Colour above, pale pinkish; below, white; with about half a dozen (number not constant) dark red vertical bars straggling irregularly down the sides looking like congealed blood. Their presence is disclosed by their footprints on the steep side of

drift sand to the leeward of the high, moving dunes. Where the track ends there is a round mark where the Skink has buried itself. The badawin plunge their hand about 2 feet into the soft sand and usually produce the Skink. I had an exhibition of their marvellous speed in burying themselves. My boy was in my tent, pitched in soft sand, and was transferring one of these Skinks from one tin to another, when it wriggled its head round towards his fingers and he dropped it. I saw this happen and plunged to the ground at the same time as the Skink, and grabbed, but it was already out of sight below the sand as if by magic. I was told in Hufuf that a certain Lizard is caught in the desert and sold at good prices in Bombay for medicine. It was called Dāmus, which is also a general term for Lizards of all denominations. While not able to speak with certainty, I think it is this Skink. In this species the digits are flattened and the scales produced laterally to a very large extent, so that the hand and foot are almost paddle-like. A closely allied species is sometimes known as the "sand fish," owing to its ability to swim through the sand. It was even described by ancient writers in works on fishes.

BATRACHIA

13. *Rana esculenta ridibunda* Pall (*d*).

5042. ♂, Hufuf.

Hufuf springs and streams. Plentiful. Edible Frog. On November 30 the chorus of Frogs in the gardens at Hufuf could be heard in the evening from my house half a mile away. On January 24 I noted that the males had assumed their courting dress. The skin becomes an emerald-green with a pale line down the centre of the back, and the eye is of shining gold of extra brilliance. The females are brown with circular brown spots. They were still very noisy and were pairing. They have 400 miles of desert between them and the next fresh water at the Shatt al Arab.

I also saw Water Tortoises commonly in the Hufuf streams; they appeared to be the same as those I had previously brought home from Bahrain springs—the Caspian Water Tortoise (*Glemmys caspica*). No Snakes were seen, but several cast skins were noticed in Hasa and Jabrin. They were probably hibernating, and I should say are not plentiful even in summer.

REPTILIA OF THE PERSIAN GULF

In addition to the Reptilia of the Arabian mainland, a list of specimens obtained by Sir Percy Cox's collector (La Personne) and myself on islands of the Persian Gulf is given below as a matter of interest. The specimens were kindly examined and reported on by Miss Joan B. Procter in 1922, and the identification is hers, and she was good enough to add a few notes to give us some idea of the distribution of the various species, which have been included with the field notes.—R. E. C.

CHELONIA

Clemmys caspica Gem. Water Tortoise. Bahrain Island.

Plentiful in the flowing springs of Bahrain. *Dist.*—Caspian Sea to Persian Gulf.

LACERTILIA

Fam. GECKONIDÆ

Alsophylax tuberculatus Blanf. Tanb Island.

Found on rocks. *Dist.*—Mesopotamia; S. Persia to Sind.

Hemidactylus turcicus L. Tanb Island.

Dist.—Borders of Mediterranean and Red Seas; Sind.

Fam. AGAMIDÆ

Uromastix microlepis Blanf. Jabal Dukhan. Bahrain.

Spiny-tailed Lizard. This was so small that I mistook it for a smaller species. It had dug out a burrow for itself, and its colour was black with red spots, much darker generally than that of the mature beast. *Dist.*—Head of the Persian Gulf.

Fam. LACERTIDÆ

Eremias brevirostris Blanf. Tanb Island, March, 1921.

Dist.—Persian Gulf; Punjab.

OPHIDIA

Subfam. COLUBRINÆ

Zamenis ventrimaculatus (Gray). Gray's Whip Snake. Bahrain, March, 1921.

Non-poisonous. Two specimens obtained by Major Daly

on Hasan Island off Bahrain. *Dist.*—From the Euphrates to Kashmir and N.W. India.

Subfam. HYDROPHIINÆ

Hydrophis ornata (Gray). Ornamented Sea Snake. One mile off Tanb Island, April, 1921.

Poisonous. Yellowish-white with sea-green bands, belly white. Both species of these Snakes are common in the Persian Gulf, sleeping coiled up and floating on the surface of the sea on calm days, and scarcely moving when touched by the wash of a steamer. The tail is flattened instead of being round and tapering as in other Snakes. *Dist.*—Mouth of Persian Gulf and coasts of India, Ceylon to New Guinea and N. Australia.

Hydrophis cyanocincta (Daud). Blue-ringed Sea Snake. Khor Abdulla, top of Persian Gulf, May, 1921.

Poisonous. Four feet in length. Black bands, belly white, tail flattened, seen on calm sea as above. *Dist.*—Persian Gulf to coasts of India, China, Japan and Papuasias.

Subfam. VIPERINÆ

Echis carinatus (Schneid). Saw-scaled Viper. Tanb Island, April, 1921.

Poisonous. La Personne says some were of a sandy colour, and others were dark, resembling the rocks, he adds. The island swarms with these Snakes, which take a heavy toll of the live-stock. They issue in the warmer months, April and May. To see if they were poisonous he allowed one to bite a tropic bird (*Phæton*), and it died within a minute. Older editions of *The Persian Gulf Pilot* mention the large number of Snakes on this island. When I visited Tanb on September 23, 1920, and again in March, 1921, I failed to find a single Snake. They are small and thin. *Dist.*—Deserts or sandy districts of Africa north of equator; S. Asia from Transcaspia and Arabia to India.

BATRACHIA ECAUDATA

Fam. RANIDÆ

Rana cyanophlyctis Schneid. Bahrain Island.

Dist.—Southern half of Arabia, and Baluchistan to Malay, and from the Himalayas to Ceylon.

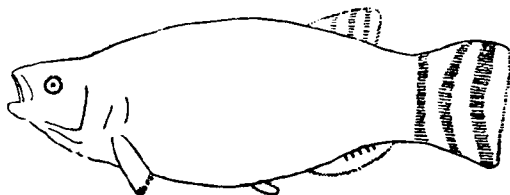
APPENDIX IV

FISH

Cyprinodon dispar—"The Hot Spring Fish."

Mr. J. R. Norman, of the British Museum, has kindly identified these fish for me. The largest male (measured in Hufuf): length 79 mm. (from end of tail to tip of lower jaw); greatest width 14 mm.; greatest depth, belly to back, 22 mm.

Iris silvery white. Mouth reddish, spreading towards eye (like a breeding male stickleback). Lower gill and belly silvery white; belly has obsolete narrow vertical dark stripes. Back bright olive-green with chequering of small sky-blue spots and



horizontal rows which increase in size towards sides and belly. Pectoral fin transparent lemon-yellow. Anal fin bright lemon-yellow with small black-and-white check along the margin nearest body. Dorsal fin (near tail) transparent olive-green chequered with narrow black vertical stripes. Tail transparent silver with two broad vertical black bands from top to bottom, which take up most of the tail and make three narrow silvery bands of the rest. The black bands are a variable feature, and some specimens have them joined together.

The largest female measured 75 mm. (= 3 inches); greatest width 16 mm.; greatest depth 22 mm.

Colour, dull olive-green. The small fins lack the chequering of the males, and the tail is without the black bands.

The adults were rare and very difficult to catch, but immature fish swarm in all the spring-fed streams of Hufuf oasis. If a bather sits still in the water, shoals of these small fish approach and nibble his legs. They are too small to bite hard, but the contact of their teeth can be felt. I would not believe this till I saw it for myself. At other times they can be seen on the mossy sides of the streams, tearing something off, and they often turn upside down with the exertion. The mouth comes out in a kind of socket, and there is a row of teeth along the outer edge of the jaw. These teeth seem proportionately smaller in adult than in small fish. Lower jaw teeth are flat and sharp, and when magnified a red vein can be seen running up each tooth. The lower jaw being undershot gives an aggressive bulldog appearance. Native boys catch the fry in baskets woven from date-leaves, but they are not eaten. The fish greedily tear a date to pieces if it is dropped in the water, thousands joining in the mêlée.

The material of the species *Cyprinodon dispar* at the British Museum is scanty, as all collectors have caught half-grown fish. Probably, thinking they had the adults, they did not try for bigger specimens, or perhaps they were unable to catch them. Thus the Hufuf specimens are the first really full-grown fish to be acquired, and there is little to compare them with. It seemed to me, from an examination of a plate of *C. dispar*, that the typical dorsal and ventral fins were very much bigger and longer in proportion to the fish's size than are the same fins of the fish from Hufuf, and it is certain that an extreme development of fin would be unsuitable in the swift-running waters of the Hasa. It is possible that in stagnant waters a more ornamental fin is grown, whereas in streams the streamline form is a necessity and the fins are smaller. We have no field notes to help us to arrive at any decision. There are specimens from Muscat and Basra, but there is nothing to tell us whether they were in still water or not. It is said there are two kinds of fish in the Bahrain springs, but we have no specimens thence and it would be useless to speculate as to their identity. Colonel Miles, who was Political Agent at Muscat in 1876,¹ mentions hot springs at Nakhil near Muscat which he visited. He found the temperature was 106° F., and remarks that there were small fish in the streams flowing from them

¹ Colonel S. B. Miles, *Geog. Journal*, 1901, p. 470.

where the water was still warm. Dr. Jayakar sent specimens from Muscat which were identified at the British Museum as *Cyprinodon dispar*, but we do not know what spring they came from. The hottest spring in Hufuf oasis is Umm al Saba. Where it flows from the basin, I saw fish swimming and found the thermometer registered 101° F. In the summer the shade temperature of the air would certainly be well over 100° and would tend to raise that of the water rather than cool it. Therefore it is established that these fish can survive a water temperature of 101° and probably several degrees hotter. By the medical definition, a hot bath commences at 96°, and 101° is as hot as you can stand it. The natives say that if the fish are put in cold water they die. The temperature of the hottest tanks in the tropical section of the Aquarium at the London Zoological Gardens is 80° F.

There are two points connected with these fish that would be of great interest especially to biologists. Firstly, to know whether they have been specialised to withstand high temperatures which would instantly kill most other species—and the impression when your hand is plunged in the water is that it would almost cook them as well. Secondly, to learn how they have been able to establish themselves in an isolated desert oasis, separated by hundreds of miles of barren country from the next open fresh water. Are they the remains of the fish that populated the rivers which, like the Wadi Sahba, once flowed over Arabia, and have they been driven by the drying up of the country nearer and nearer to the source, or have they been brought by some other agency? If so, the theory that fish are colonised by being carried as eggs on the breasts and feet of wild-fowl comes up for discussion.¹ Nature seldom provides such a precarious means of transport for the distribution of its species as this sounds. If the eggs were laid in hard indigestible cases and were swallowed by the bird, a system already adopted by parasitic insects, this would be more readily acceptable as a solution of the problem.

The specimens have all been presented to the British Museum.

Two instances of fish living in hot or tepid springs may be of interest, although in neither case has the species been identified.

Doughty speaks of little silver-green fishes in tepid springs savouring of sulphur in Kkeybar oasis (*Arabia Deserta*, Vol. II. p. 188) and also in the Peræa (Vol. I. p. 27), and Sir Arnold

¹ I have been unable to find any proof that competent observers have seen eggs of fishes carried in this way, although such evidence may exist.

Wilson has drawn my attention to the *Reminiscences* of Professor A. H. Sayce, who, writing of Algeria, says (p. 249): "A few days later we were at Hammam Meskoutin, where the sulphurous hot springs cover the limestone plateau with miniature volcanoes of cone-like shape. In one place the hot water falls over the edge of a cliff into the stream below, turning the face of the cliff into lands of red, pink, and yellow, like the famous "terraces" of New Zealand. Still boiling, the water pours itself into the stream and, although it scalds the hands, if put into it, ghostly-looking fish, white and semi-transparent, are seen swimming in it whose ancestors migrated from the cold water beyond and were gradually acclimatised to the conditions of a torrid zone." Although this indicates that fish were living in the scalding water I should think that, had the temperature been taken where the fish actually were, it would have been found that the waters had cooled considerably between that part and the scalding basin. An interesting experiment for those who have facilities would be to ascertain, by gradually raising the temperature of the water, what is the limit of heat that *Cyprinodon dispar* is able to withstand, and whether successful resistance to high temperatures is accompanied by any physical specialisation.

APPENDIX V

INSECTS

THE Collection of Insects was handed over to Major E. E. Austen, of the British Museum (Natural History), who kindly undertook the distribution of the various groups, and the identification was made by the following specialists of the Staff.

<i>Lepidoptera</i> (<i>Rhopalocera</i>)	.	Mr. N. D. Riley.
„ (<i>Heterocera</i>)	.	Mr. W. H. T. Tams.
<i>Coleoptera</i>	.	Mr. K. G. Blair, B.Sc.
<i>Hymenoptera</i>	.	Dr. J. Waterston, B.D.
<i>Diptera</i>	.	Major E. E. Austen, D.S.O., and Mr. F. W. Edwards, B.A.
<i>Hemiptera</i>	.	Mr. W. E. China, B.A.
<i>Odonata</i>	.	Mr. K. G. Blair, B.Sc.
<i>Orthoptera</i>	.	Dr. B. Uvarov.

In addition to these a large hairy Spider (*Ferrimundalum*) secured at Jabrin has proved to be *Galeodes arabs*.

A small green larva with white line down the back, which appeared to be that of a Saw-fly, was devastating large areas of lucerne in Hufuf on January 19, 1924. Lady-birds were present in numbers and were feeding on the pest, but made no impression. The only measure being taken was to dig up and resow the infected areas.

A White Ant was seen on sand-dunes in the Jafura Desert, and Black Ants were noted in several localities between Hasa and Jabrin.

Doughty, in *Arabia Deserta* (Vol. II. p. 199), mentions azure, dun and vermilion Dragon-flies seen at Kheybar oasis. This description would indicate the three species seen by me at Hasa.—R. E. C.

LIST OF INSECTS COLLECTED BY MAJOR R. E. CHEESMAN IN ARABIA

With the exception of the *Lepidoptera* this list contains little that is new or of special interest. The beetles, grasshoppers,

etc., are all such as from their known distribution might have been expected to occur in the districts visited, while the rare and interesting species that might have been anticipated from a part of Arabia so little worked are disappointingly absent.

The Lepidoptera, however, are more interesting; two essentially Palæarctic butterflies, *Papilio machaon* and *Colias crocea*, not having previously been recorded from as far south, while for *P. demoleus* the capture marks an eastward extension of its range. The most noteworthy of the butterflies is undoubtedly a new local race, now named after its discoverer, of *Precis orithya* L. Sixteen specimens of moths contain nine species, of which four are new. Of these *Cossus cheesmani* and *Trichoclea avempacei* are quite unlike anything known from the area which extends from North Africa through Syria and Persia to Afghanistan. The other species are akin to forms known from this area.

COLEOPTERA (Beetles)

GYRINIDÆ (Whirligig Beetles)

Dineutes æreus Klug. From Lahej, Muscat, Aden, Socotra and tropical Africa to Natal. Hufuf, 14. xii. 23.

Dineutes sp. ? Hufuf, 14. xii. 23.

COCCINELLIDÆ (Lady-birds)

Coccinella 7-punctata L. Europe, Asia and part Africa. Hufuf, 29. xi. 23.

TENEBRIONIDÆ (Darkling Beetles)

Tentyria giraffa All. Arabia, Sinai. Hufuf, 1. xii. 23.

Adesmia clathrata Sol. Persia, Mesopotamia. Hufuf, 1. xii. 23.

Akis subtricolorata Redt. Persia, Mesopotamia, Arabia. Hufuf, 1. xii. 23.

Pimelia arabica Klug. Egypt, Arabia, Hejaz, Hadhramaut. Hasa.

SCARABÆIDÆ (Sacred Beetles)

Scarabæus compressicornis Klug. Egypt, Abyssinia, Arabia, Persia, Karachi. Jabrin.

MELOLONTHIDÆ (Chafers)

Tanyproctus sp. ? (badly broken). Jabrin, 22. ii. 24.

HYMENOPTERA (Bees, Wasps, etc.)

- Cryptocheilus flavus* Fabr. (a species of Hunting Wasp). Hufuf,
29. xi. 23.
Campoplex (*sens. lat.*) sp.? (a species of Ichneumon). Hufuf,
14. xii. 23.

LEPIDOPTERA RHOPALOCERA (Butterflies)

- Papilio machaon* L. (the Swallow-tail). Hufuf, 20. xi. 23.
,, *demoleus* L. (the Lime Butterfly). Hufuf, 20. xi. 23.
Colias crocea Fourc. (syn. *C. edusa*) (the Clouded Yellow). Hufuf,
20. xi. 23.
Lampides bæticus L. (Long-tailed Blue). Hufuf, 20. xi. 23.
Zizera lysimon Hb. Hufuf, 20. xi. 23.
Precis orithya Linn. (new subspecies, *cheesmani*, Riley). Hufuf,
20. xi. 23.

LEPIDOPTERA HETEROCERA (Moths)

NOCTUIDÆ

- Agrotis subspinifera* Hampson. Hufuf, 1. xii. 23.
Agrotis saracenicæ Tams (new species). Jabrin, 21. ii. 24.
Trichoclea avempacei Tams (new species). Hufuf, 23. i. 24.
Callistege albifusa de Joannis. Hufuf, 29. xi. 23.

COSSIDÆ

- Cossus cheesmani* Tams (new species). Jabrin, 23. ii. 24.

PYRALIDÆ

- Heterographis fulvimarginella* Hampson. Jafura, 26. ii. 24.
Cornifrons ulceratalis Lederer. Hufuf, 29. ii. 24.
Tegostoma confluentalis Hampson. Jafura, sand-dunes, 26. ii. 24.
Noctuella avicennæ Tams (new species). Jafura, sand-dunes,
26. ii. 24.

DIPTERA (Two-winged Flies)

CULICIDÆ

- Culex fatigans* W. (common household Mosquito of the Tropics).
Hufuf, 12. xii. 23.

MUSCIDÆ

Stomoxys calcitrans L. (Stable Fly). Persian Gulf, Kuwait, 31. iii. 24. (caught on board s.s. *Frankenfels*).

HEMIPTERA (Bugs)

Hydrocyrius columbiæ Spin. (Giant Water Bug. A male with 90 eggs forcibly fixed on his back by female.) Trop. Africa, Madagascar, etc. Hufuf, 24. xii. 23.

ODONATA (Dragon-flies)

Orthetrum sabina Drury. Arabia to Australia and the Pacific Islands. Hufuf, 15. xii. 23.

Trithrerinia annulata Beauv. Africa. Hufuf, 15. xii. 23.

Philonomon luminans Karsch (?). Hufuf, 15. xii. 23.

ORTHOPTERA (Grasshoppers, Locusts, etc.)

MANTIDÆ

Hypsicorypha gracilis Burm. N. Africa (Canary Islands to Egypt.) Jabrin, 21. ii. 24.

ACRIDIDÆ

Acridella nasuta L. S. Palæarctic. Jabrin, 1. iii. 24.

Catantops saucius Burm. Cape Verd Islands to Egypt, Seychelles (abundant). Hufuf, 14. xii. 23.

Acrotylus insubricus Scop. S. Palæarctic (very common). Hufuf, 14. xii. 23.

(From the *Annals and Magazine of Natural History*, Ser. 9, Vol. XV. p. 151, January, 1925.)

List of the Butterflies collected in Arabia by Captain R. E. Cheesman, with a Description of One new Subspecies. By N. D. RILEY.

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NYMPHALIDÆ

Precis orithya cheesmani, subsp. n. (Plate 66, 5, 6.)

♂ ♀. Nearest to *P. orithya here* Lang,¹ but the white post-discal band of the fore wing above entirely suffused with blue—

¹ *Entom.* xvii. p. 207 (1884).

i.e. the ocellus in area 2 is completely surrounded (but not so strongly on its outer side) by blue, which extends thence to the costa; the costa of fore wing and the marginal areas of both wings, but especially of the hind wing, darker than in *here*. Underside like that of *here*, but much less ochreous, almost pale sooty-grey in general tone, especially the tornal area.

Hufuf, 20. xii. 23, 1 ♀; 29. xi. 23, 3 ♂, 2 ♀.

B.M. type no. Rh. 241 ♂, 242 ♀; co-types, 243, 244 ♂, 245, 246 ♀.

Very little variation is visible in the three males; the three females, on the other hand, exhibit a good deal. One specimen has the white fore-wing band hardly at all suffused with blue. The underside of this specimen is like that of the males. In the other two females the underside is of the drier type. In one of them it is almost uniform purplish-grey; the other is intermediate.

Precis here was originally described from specimens in the B.M. from Aden and Mesopotamia. The occurrence of this most distinct race in a locality almost exactly intermediate between these two places seems to indicate a degree of isolation in the fauna of Hufuf which would hardly have been suspected.

PAPILIONIDÆ

Papilio machaon L.

Hufuf, 1 ♂, 20. xi. 23; 1 ♂, 24. xii. 23.

Papilio demoleus L.

Hufuf, 2 ♂, 1 ♀, 20. xi. 23.

The occurrence of *Papilio machaon*, an essentially Palæarctic species, in this locality is a little unexpected. It is, of course, well known from Syria, Palestine, and Mesopotamia; but Hufuf is considerably removed geographically, if not so well separated faunistically, from all these countries. *Papilio demoleus*, on the other hand, was more likely to be met with. Its occurrence, however, considerably extends its known range, the nearest localities from which it had previously been recorded being Persia and Muscat, the latter in the extreme north-east of Arabia.

PIERIDÆ

Colias crocea Fourc.

Hufuf, 1 ♂, 20. xi. 23.

The same remarks apply to this species as to *Papilio machaon*.

LYCÆNIDÆ

Zizera lysimon Hb.

Hufuf, 2 ♂, 20. xi. 23; 1 ♂, 1 ♀, 29. xi. 23.

Lampides bæticus L.

Hufuf, 1 ♂, 29. xi. 23.

Both these "Blues" were to be expected. Both have a very wide distribution throughout the southern Palæarctic and the Indo-Australian regions.

(From the *Annals and Magazine of Natural History*,
Ser. 9, Vol. XV. p. 144, January, 1925.)

List of the Moths collected in Arabia by Captain R. E. Cheesman, with Descriptions of Four new Species. By W. H. T. TAMS.

(Published by permission of the Trustees of the British Museum.)

All the species, as might be expected, exhibit the colour-characteristics peculiar to African desert-moths. Four new species in such a small number of specimens from three widely separated localities is a remarkably high percentage, and it may reasonably be expected that further collecting in these regions will produce much interesting desert material. In spite of the smallness of the collection, it contains species occurring in or closely related to species from Egypt, Persia, and N.W. India.

NOCTUIDÆ

AGROTINÆ

Agrotis subspinifera Hmps. n.

Agrotis subspinifera Hampson, *Cat. Lep. Phal. B.M.* iv. p. 205, pl. lxi. fig. 19 (1903).

1 ♀, Hufuf, 1. xii. 23. The ♂ type and another ♂ came from Ferozepore, Punjab, Oct. 1897 (*Nurse*).

Agrotis saracenicæ sp. n. (Plate 66, 1.)

♂. Facies of *Agrotis hodnæ* Oberthür, but darker in colour. Antennæ serrate-fasciculate, the shaft above with buff scales mixed with some hair-brown scales. Frons in structure like that of *Agrotis segetum* Schiff., but with the apex of the prominence pear-shaped in outline, the narrow end uppermost. Palpi cream-buff, the basal and second segments shaded on the outer side with fuscous. Head and thorax drab, white and

sepia mixed, many of the darker scales white-tipped; tegulæ whiter than rest of thorax. Pectus cartridge-buff. Abdomen above and beneath cartridge-buff, irrorated with drab. Legs cream-buff, the tibiæ with a few drab or hair-brown scales, the tarsi with the larger part of each segment sepia, the tips only being cream-buff. Fore wing ground-colour drab, the veins and pattern fuscous-black, with white splashings on each side of the veins and in and above the orbicular. Claviform marking outlined with fuscous-black, extending along the anal fold to a point opposite to the junction of vein *Cu* 2 with the cell. Orbicular elongate, but not confluent with the reniform; finely outlined with fuscous-black, with a central patch of drab scales surrounded by white and cream-buff scales; reniform large, filling the end of the cell, heavily outlined with fuscous-black and almost filled with fuscous-black; a heavy fuscous-black shade on the costa above the reniform; an obscure fuscous-black band from reniform to inner margin, slightly converging towards termen; a subterminal row of six interneural fuscous-black arrow-head dashes below vein *M* 1, the dash above the anal vein being less well-defined than the others; a patch of fuscous-black shading between veins *M* 1 and *M* 2, from the arrow-head dashes to termen; terminal line thickened interneurally, black; fringe fuscous, with a cream-buff line at base. Ground-colour modified above, in and beyond end of cell, by an admixture of cream-buff scales. Hind wing white, with a fine fuscous terminal line, thickened interneurally; fringe white. Underside almost entirely white; fore wing with costa irrorated with fuscous and fuscous-black; a curved fuscous dash across end of cell; a curved fuscous shade from costa to vein *R* 5 postmedially; a diffuse drab subterminal shade, broader and darker at costa, parallel with termen; terminal line fine, fuscous-black, thickened interneurally; hind wing white, faintly irrorated with drab on the costa, a few fuscous scales above the middle of the discocellulars.

Expanse 40 mm.

Holotype ♂, Jabrin, 200 miles S.S.W. of Hufuf, 21. ii. 24.

HADENINÆ

Trichoclea avempacei Tams, sp. n. (Plate 66, 3.)

♂. Palpi cartridge-buff, sparsely irrorated with fuscous-black. Antennæ bearing bristles and cilia; bristles at middle of antennæ slightly longer than diameter of shaft, length of cilia about two-

thirds of length of bristles; upper side of shaft cartridge-buff. Frons prominent, rounded, transversely rugose; clothed with cartridge-buff scales, with a transverse band of fuscous shading at the middle. Vertex of head cartridge-buff, irrorated with fuscous-black. Thorax whitish mixed with cartridge-buff, irrorated with fuscous-black. Pectus cartridge-buff. Abdomen above and beneath cartridge-buff, irrorated with fuscous. Legs cartridge-buff irrorated with fuscous-black, fore tarsi with a narrow band of fuscous-black on the middle of the first two segments, the other three segments fuscous-black above; mid-tarsi with the second segments heavily shaded with fuscous-black on the proximal two-thirds, the last three segments almost entirely fuscous-black above; hind tarsi with the third segment shaded with fuscous-black on proximal two-thirds, the fourth and fifth fuscous-black above. Fore wing whitish, tinged with cartridge-buff along the costa, in and beyond the cell, along the lower edge of the cell to the termen, and along the middle of the inner margin, these cartridge-buff-tinged areas sparsely irrorated with clay-coloured scales; the cell-margins irrorated with black and fuscous scales; veins from the cell black, except near the cell; veins *Sc*, *R* 1, and *R* 2 bearing black scales towards their junction with the costa; reniform large, black-outlined except towards the costa, where it is open, filled with an inner reniform patch of fuscous, fuscous-black, and white scales, separated from the black outline by a cartridge-buff-tinged whitish ring; orbicular black-outlined, oval, touching reniform, open basad, containing a patch of grey and drab surrounded by white, the black outline on the lower side continued as a wavy line for a distance slightly greater than the length of the orbicular, with, after a short break, a fuscous line to the wing-base; a broad black streak from wing-base to the lanceolate claviform, which is long, outlined with black, and partially filled with a long narrow patch of fuscous mixed with whitish; a fine black line from apex of claviform along anal fold to termen. A short black dash along the anal vein near the base, another near the termen; a fuscous-irrorated drab patch, in area equal to the reniform, which it adjoins, lying between veins *M* 2 and *Cu* 1; a diffuse greyish shade between veins *R* 4 and *R* 5, not filling the whole interspace; six terminal interneural fuscous-edged black striæ between *R* 5 and the anal vein (*A* 2), the two middle striæ, lying between *M* 2-*M* 3 and *M* 3-*Cu* 1, being the longest, and running into the fuscous-irrorated drab patch adjoining the reniform; fringe alternately

cartridge-buff and fuscous-black, the latter interneurally. Hind wing cartridge-buff, suffused with fuscous, lighter at base, becoming darker towards termen; a fuscous dot at middle of discocellulars; fringe cartridge-buff with a few fuscous scales. Underside of fore wing cartridge-buff, irrorated with fuscous-black and black, beyond and below the cell suffused with light brownish-drab irrorated with whitish; a large fuscous-black reniform stigma at end of cell; fringe as on upperside, except for the fuscous-black interneural streaks, which have the basal half cartridge-buff. Underside of hind wing cartridge-buff irrorated with black, the veins towards the termen and the termen itself accentuated with black; fringe cartridge-buff, with a few fuscous scales.

Expanse 29 mm.

Holotype ♂, Hufuf, 23. i. 24.

CATOCALINÆ

Callistege albifusa de Joannis.

Callistege albifusa de Joannis, *Bull. Soc. ent. Egypt.* 1909, p. 165.

1 ♀, Hufuf, 29. xi. 23.

COSSIDÆ

Cossus cheesmani Tams, sp. n. (Plate 66, 2.)

♂. Palpi cartridge-buff, outwardly shaded with fuscous. Shaft and pectinations of antennæ lightly covered with white scales, barely hiding the olive-brown colour of the chitin beneath. Head, thorax, and abdomen, dorsally and ventrally, cartridge-buff. Legs cartridge-buff; fore femora shaded above with drab, fore tibiæ with three indistinct bands of fuscous irroration—two in the proximal third, the other marking off the distal third; each fore tarsal segment ringed at the middle with olive-brown; mid and hind legs with only the faintest traces of rings on the tarsal segments. Fore wing white, suffused with maize-yellow between costa and upper margin of cell, between end of cell and termen, and, with the exception of a white strip along the anal vein (*A* 2), between the lower margin of the cell (up to vein *Cu* 2) and the inner margin of the wing; markings striate rather than reticulate; clove-brown striæ along the costa, in the end of the cell, and below the cell in the basal third of the wing; remainder of striæ olive-brown; basal half of cell and patches between the postmedial and subterminal striæ and below end of

cell not striate; a terminal series of olive-brown spots at the vein-ends, increasing in size from apex of wing to anal vein; fringe white, marked at the veins with faint traces of drab. Hind wing white, the veins but lightly covered with scales; faint traces of striation in the cubital and anal areas; faint olive-brown spots on termen at veins, with traces on fringe. Under-side cartridge-buff; fore wing with costal and subterminal striæ evident; hind wing with traces of striæ on costa and in cubital and anal areas.

Expanse 48 mm.

Paratype ♂. Paler in colour of markings; striæ buffy brown to ochraceous-buff, more reticulated and more evenly distributed over fore wing.

Holotype ♂ and paratype ♂, Jabrin, 200 miles S.S.W. of Hufuf, 23. ii. 24.

This species resembles *Cossus ægyptiaca* Hmps., but differs from it in the following features:—Both fore and hind wings are longer and narrower, markings lighter and showing less reticulation, hind wings almost free from markings, and under-side with few striæ.

The description of *Cossus ægyptiaca* Hmps. is most misleading, as it was made from a specimen which had become badly greased. This specimen has been cleaned for comparison with the species here described; but as this is not a suitable opportunity for the redescription of an Egyptian moth, I propose to leave that until I have material sufficiently good to make a satisfactory description possible.

PYRALIDÆ

PHYCITINÆ.

Heterographis fulvimarginella Hmps.

Heterographis fulvimarginella Hmps., *J. Bomb. Nat. Hist. Soc.* xv. p. 23 (1903).

1 ♂, 3 ♀♀, Jafura sand-dunes, 26. ii. 24.

These moths occurred in such numbers that they extinguished Captain Cheesman's lamp.

PYRAUSTINÆ.

Cornifrons ulceratalis Led.

Cornifrons ulceratalis Led., *Wein. ent. Monat.* ii. p. 147, pl. iv. fig. 1 (1858).

1 ♂, 2 ♀♀, Hufuf, 29. ii. 24.

Tegostoma confluentalis Hmps. n.

Tegostoma confluentalis Hmps. n., *Ann. & Mag. Nat. Hist.* (8) xii. p. 299 (1913).

1 ♂, 1 ♀, Jafura sand-dunes, 26. ii. 24.

Noctuella avicennæ Tams, sp. n. (Plate 66, 4.)

♂. Palpi, scaling of antennal shaft, head and thorax tawny-olive. Abdomen olive-buff. Pectus and underside of abdomen drab-grey to pale drab-grey or dirty whitish. Legs tawny-olive above, whitish beneath. Fore wing drab mixed with warm buff, producing a general tawny-olive effect; a fuscous-black medial line, commencing as an acute-angled V (on its side, apex basad), with the tip of its upper arm in the upper angle of the cell and the tip of its lower arm in the lower angle, whence the line takes a sharply oblique slightly curved course basad, enclosing in the angle thus formed a pointed white patch, which merges into the ground-colour basad; an oblique fuscous-black postmedial line, forming three dentations (points terminad) above vein *M*₁, below which it curves basad (convexity terminad) to vein *Cu*₂, turning and diverging slightly from the medial till it reaches vein *A*₂, where it turns sharply terminad, curves round and runs into the inner margin at right angles; the whole line accentuated on the basad side with white, most strongly from the costa to vein *Cu*₂; an indefinite subterminal line from the apex diverging slightly from the termen, becoming lost in a whitish patch at the tornus; between the postmedial and the subterminal a drab shade; a fuscous terminal edging preceded by white; fringe with a row of short fuscous-tipped buff scales, and a row of long white scales mixed with fuscous scales at the ends of the veins. Hind wing light olive-buff with fuscous shading deepening towards the termen; a distinct fuscous subterminal shade, accentuated with fuscous-black at vein *Cu*₂, preceded at this point by a dash of white, and followed by a patch of tawny-olive with a dash of white before the fuscous terminal edging; fringe as in fore wing, but fuscous scales at vein *Cu*₂ only. Underside pale olive-buff; traces of upper-side pattern; fore wing with traces of tawny-olive along costa, cartridge-buff between cell and inner margin and also between the oblique lines; cell and subterminal area shaded with drab; a series of whitish dashes on the veins and between them, before the termen; fringe much as on upperside; hind wing with costal margin suffused with cream-buff; traces of fuscous postmedial line; termen and fringe as on upperside.

Expanse 22 mm.

Holotype ♂, Jafura sand-dunes, 26. ii. 24.

N. avicennæ is very nearly related to *N. albidalis* Hmps., which was described from a somewhat worn female from Fao. The two are alike in size, but the Fao female, which is very pale and seems to have lost many of its markings, may be a faded specimen. The scheme of the pattern resembles that of *N. desertalis* Hübn., which is, however, a larger moth.

I have named the *Cossus* in honour of Captain Cheesman, who made this collection. The *Trichoclea* I have called after Avempace, a Moslem philosopher who was born at Saragossa and who died at Fez in 1138. The *Noctuelia* I have named after Avicenna, who was famous among the Moslems as a physician and philosopher, who translated the works of Aristotle and influenced scientific thought in Europe during the eleventh century.

APPENDIX VI

BOTANICAL NOTES

Botanical Notes. By R. D'O. GOOD and C. NORMAN.

THE botanical collection made by Major Cheesman in Hasa, Jafura, and Jabrin, Eastern and Central Arabia, which has been presented by him to the Herbarium of the British Museum, consists of 35 species, 13 being cultivated plants, the remaining 22 indigenous. Of these latter 14 are Dicotyledons, 6 are Monocotyledons. The remaining two are Ferns. One of these is the well-known and almost cosmopolitan Maiden-hair Fern (*Adiantum capillus-Veneris* L.). The other is *Ceratopteris thalictroides* Brongn., a most remarkable plant with a very anomalous structure. It is the only representative of its family and is especially interesting because it grows totally submerged in still or slowly-running water. Its distribution is pan-tropical and it also extends into the sub-tropics. Major Cheesman's specimens were found in the hot springs of Hufuf, where the water is permanently at a temperature of just under 90° F. I can find no other records of this plant from such a habitat, and its ability to maintain itself and to multiply vigorously under such conditions is very remarkable. The Hufuf specimens bear no sporangia, but many of the thalli have given rise to vegetative buds along the margins.

The Phanerogams fall under two heads, namely, widespread desert or saline types and occasional more hygrophilous plants occurring in the oases. Among the latter is *Orchis palustris*, a plant widely spread in Europe. It also occurs in North Africa and the Orient, but does not seem to have been recorded from Arabia. The ubiquitous Common Reed (*Phragmites*) is also a feature of these spots. *Acacia flava* is one of the few trees.

The characteristically desert plants comprise twelve species—all Dicotyledons. The most conspicuous family is the *Chenopodiaceæ* with three species. The *Compositæ*, on the other hand, are represented by only one species, but economically this is

one of the most important plants of the deserts. There are also two interesting parasitic plants. *Phelipæa lutea* (closely related to our native Broom-rapes) lives upon *Chenopodiaceæ*, etc. *Cynomorium coccineum*, one of the *Balanophoreæ*, also exploits the same hosts, and the two parasites are often to be found growing close together and living under precisely similar conditions, although entirely unrelated. *Calotropis procera*, a widespread *Asclepiad*, is perhaps the most luxuriant plant of the desert flora.

These twelve desert species all have a distribution in a latitudinal direction through various distances over the chain of deserts stretching from N.W. Africa to W. India. *Calotropis procera* covers nearly the whole distance and also extends down into tropical Africa. *Rhanterium epapposum* also ranges from N. Africa to Baluchistan. *Phelipæa* has a similar distribution, reaching to Spain in the N.W. In general the remaining species may be divided according to the parts of the desert chain which they occupy. Three species are found in the Central portion; two are found in the Eastern half and four in the Western half. This distribution in a latitudinal direction is but what might be expected from the situation of the deserts and saline lands. At the same time it is of interest in connection with the presence of a marked African-Indian element in the flora of tropical Africa—an element which does not comprise an undue proportion of xerophilous forms.

The following is a list of the plants collected, together with the collector's notes.—R. D'O. G.

INDIGENOUS AND CULTIVATED PLANTS

INDIGENOUS PLANTS

PHANEROGAMS

RESEDACEÆ

1. *Ochradenus baccatus* Del. "Gurdhī." Jafura Desert, in flower February 14. A mignonette in stools, 2 feet high, greedily eaten by camels. Rare. *Dist.*—Egypt, Persia, Sind.

ZYGOPHYLLACEÆ

2. *Zygophyllum album* L. "Hamdh" or "Rimdh." Hasa and Jabrin. A fleshy-leaved bush, 2 feet high, on raised mounds of drift sand. Eaten by camels, but not suitable

for waterless marches as it makes them thirsty. *Dist.*—Canaries, N. Africa, Syria, Asia Minor.

LEGUMINOSÆ

3. *Alhagi Maurorum* Desv. "Shok Shibram." Jabrin. A straggling, thorny plant, 1 foot high, called "Aqul" in Iraq. Eaten by camels. *Dist.*—N. Africa, Syria.
4. *Acacia flava* Schweinf. "Salam." Hasa and Jabrin. Acacia trees, 20 feet high (Plate 53). Grows in depressions and dry Wadi beds. Eaten by camels in spite of long thorns. *Dist.*—Arabia, Persia.

COMPOSITÆ

5. *Rhanterium epapposum* Oliv. "Arfaj." Hasa and Jabrin. Bush, 2 feet high (Plate 30). The commonest plant on gravel plains; in flower January 12 to March 1. Eaten by camels. *Dist.*—N. Africa, Arabia, Beluchistan.

PLUMBAGINÆ

6. *Statice axillaris* Forsk. Oqair. Stools 6 inches, like Sea Lavender in flower spike. In flower March, 1921. *Dist.*—Egypt, Somaliland and Arabia.

APOCYNACEÆ

7. *Rhazya stricta* Decn. "Hamal." Jafura. Shrub, 2 feet; leaf and growth resembles Azalea in distance, flower minute. In flower February 16. Camels will not touch it. *Dist.*—Arabia, Afghanistan, Sind.

ASCLEPIADACEÆ

8. *Calotropis procera* R.Br. "Ashurr." Umm al Dharr. In dune country between Oqair and Hufuf. Shrub, 10 feet; thick milky juice flows when broken (Plate 12). Large, green kidney-shaped fruit, bark thick cork. In flower November. *Dist.*—N. Africa, Arabia, Persia, Sind, Punjaub, Ceylon.

CONVOLVULACEÆ

9. *Convolvulus* sp. nr. *lanatus*. Salwa. 6 inches high, large purplish petals. In flower March, 1921.

OROBANCHACEÆ

10. *Phelipæa lutea* Desf. "Dhanun." Hasa. Yellow flower spike like a Broom-rape, 1½ feet (Plate 11). In flower

January 2 to March 1. Plentiful. Thick, succulent, underground stem. Parasitic on plant roots in soft sand. Eaten by camels. *Dist.*—Spain, N. Africa to India.

CHENOPODIACEÆ

11. *Arthrocnemon fruticosum* Moq. "Gadha." Jabrin. Bushes, 4 feet on soft sand-hills, salt bush group (Plate 57). Eaten by camels. *Dist.*—America, Europe, N. Africa, Arabia.
12. *Suaeda vermiculata* Forsk. "Sawad." Jabrin. Bush, 3 feet high, salt bush group (Plate 50). Fleshy leaves vary from yellow to dark purple. Eaten by camels. *Dist.*—Canary, N. Africa, Egypt, Arabia.
13. *Seidlitzia Rosmarinus* Bunge. "Shinan." S. Jabrin. Bush, 3 to 5 feet, salt bush group (Plate 49). Fleshy leaves paler than "Sawad." Eaten by camels. *Dist.*—Egypt, Arabia.

POLYGONACEÆ

14. *Calligonum comosum* L'Herit. "Aabel." Hasa and Jabrin. Bushes, straggling, up to 8 feet. Plentiful in sand-dunes (Plate 35). Male flowers pink or yellow fluffy balls; female flowers, small, usually on separate branch. In flower February. Eaten by camels. *Dist.*—N. Africa, Arabia, Persia.

BALANOPHOREÆ

15. *Cynomorium coccineum* L. "Tarthuth." Hasa deserts. A dark red flower spike, $1\frac{1}{2}$ feet, flowers minute (Plate 11). Large, succulent underground stem eaten by badawin and sold in markets, where townspeople walk about gnawing them. Parasitic on plant roots in soft sand. In flower February and March. *Dist.*—Mid. region and C. Asia.

ORCHIDACEÆ

16. *Orchis palustris* Willd. Umm al Saba, Hufuf. Flower spike $1\frac{1}{2}$ feet, petals pale puce, leaves green and unspotted, several specimens growing in marshy land among thick rushes. In flower January 28. Faint, sweet smell. Finding an Orchis similar in some ways to the Purple Orchis of England, in a desert oasis, was one of the surprises of the expedition. *Dist.*—Continental Europe, N. Africa, Orient.

JUNCACEÆ

17. *Juncus acutus* L. Hufuf oasis. 4 feet. The wiry leaves of this rush have a sharp spike at the point and it is very painful to walk about in them. *Dist.*—Temperate regions.

CYPERACEÆ

18. *Fimbristilis*, cf. *ferruginea* Vahl. Hufuf oasis. 4 feet. In flower January 2. Like the last, this rush grows round rice-fields and along streams. Leaves are very sharp at point and are used in the manufacture of reed matting. *Dist.*—A widespread species.

GRAMINEÆ

19. *Dactyloctenium ægyptiacum* Willd. Hufuf oasis. A grass, low growing, found along water channels and damp places near cultivation. Flower spike like bird's foot with but three toes.
20. *Phragmites communis* L. Hufuf oasis. 7 to 8 feet. In seed January 2. Reed growing in flooded areas and on rice lands; is cut, harvested and used extensively for reed matting for floors, made by women and seen in most houses. The fine stems are used without splitting and make a neat, closely woven mat which is sold in long strips in the markets.

CRYPTOGAMS

21. *Adiantum capillus-Veneris* L. Hufuf oasis. Maiden-hair Fern growing along damp banks of water channels and in masonry of bridges.
22. *Ceratopteris thalictroides* Brongn. Umm al Khorasan spring, Hufuf oasis. A bright green Water Fern, the only known representative of its family. Plants were entirely submerged in warm water of the spring. Has two distinct shapes of leaf, one a much-lacerated outline. On the edges of leaves complete young plants were formed.

Two kinds of Acacia were seen, for which the Arab names are "Salam" and "Aqul." Both are trees, and they appear in the photographs, but no specimens of Aqul were brought home. The Aqul of Jabrin is not the small thorny scrub called Aqul in Iraq.

CULTIVATED PLANTS

LEGUMINOSÆ

23. *Cajanus indicus* Spreng. Hufuf. In bloom November 20. A yellow-flowered, Vetch-like plant, not plentiful in November. Cultivated throughout Tropics.

LYTHRACEÆ

24. *Lawsonia alba* Lam. "Henna." Hufuf. Not in flower November 11. A row of the bushes, 5 feet, and looking like Privet, can be seen in most gardens. The stems and leaves are dried, pounded and made into a fine paste with acid and smeared on finger- and toe-nails; when dry it is removed and leaves a permanent brown stain; nails coloured thus are considered the acme of refinement. Many white donkeys are disfigured with red designs made with Henna by way of ornament. It is also believed to harden the skin and prevent saddle galls. The Persian custom of staining the hair and beard red with Henna is not in favour in Arabia.

UMBELLIFERÆ

25. *Anethum graveolens* L. "Halwa." Hufuf. In flower November. English, Aniseed; umbels of small yellow flowers; 2 feet. Grown in most gardens; much in favour for flavouring. The famous Hasa dates, called Khelas, are often sprinkled with the seed and then packed.

SALVADORACEÆ

26. *Salvadora persica* L. "Raka." Abu Zahmul, Oqair. A large, thick clump of bushes, 4 to 5 feet high, growing in ruin-field. Sticks are cut from it for polishing teeth. As this was the only locality this plant was seen in, I have assumed it was once cultivated there. Philby reports it from Wadi Dawasir. *Dist.*—Tropical N. Africa, Arabia, Persia, Sind, Ceylon.

SOLANACEÆ

27. *Withania somnifera* Dun. Hufuf gardens. In flower November 28. 3 feet. Probably used medicinally. *Dist.*—Mediterranean, Trop. S. Africa, Arabia, Persia, India.

LABIATÆ

28. *Ocimum basilicum* L. Hufuf gardens. Height 2 feet, in flower November 25. A Thyme-like plant with similar smell; said to be grown because the women-folk like it.

NYCTAGINEÆ

29. *Mirabilis Jalapa* L. Hufuf gardens. In flower November 28. Small, crimson, trumpet-shaped flower.

AMARANTHACEÆ

30. *Digera arvensis* Forsk. Hufuf. A low, insignificant plant, probably a weed among cultivation. *Dist.*—Tropical Africa to India.

GRAMINEÆ

31. *Phalaris minor* Retz. "Reshadi." Hufuf corn-fields. In flower February 3. The plant called Canary Seed, growing possibly as a weed among irrigated wheat. It was being picked out and given as green fodder to animals. *Dist.*—Greece, Orient, S. Africa.
32. *Triticum durum* Steud. See *T. vulgare*.
33. *Triticum vulgare* Vill. Hufuf. Strong, healthy, dark green straw, 3 feet 6 inches high. Wheat sowing was general at the end of November, and it was coming into ear February 3. Several fields of bearded Wheat of above two varieties were seen in the Hasa oasis, but the area under Wheat is not great, although this is the only winter corn grown. Barley is not grown. I searched the oasis diligently. I found only one instance of Barley sown in tufts round a small Lucerne patch. Wheat is sometimes sown on rice-fields which are dried off between rice crops.

Commercial Samples of local-grown Wheats from the Hufuf Bazaar

- (1) *Triticum vulgare* : Arabic "Saidiya." A good even example of a well-grown hard Wheat : considered the best and highest priced in the market.
- (2) 2nd Grade : Arabic "Kodla." *Triticum durum* and *Triticum vulgare* mixed, and contains 9 per cent. of thin, small-grained Barley. This fetches a lower price than No. (1).

34. *Pennisetum dichotomum* Del. A little foxtail Millet, 3 feet, grown in stools round Lucerne patches.
35. *Oryza sativa* L. Hufuf oasis. Rice was being cut and harvested November 23. It is not considered of very good quality and is eaten by the peasants. The best rice is imported from India. Large areas on low-lying ground at the tail-end of canals are paddy fields, date palms growing round the high, enclosing banks.
36. *Cordia Myxa* L. var. Tree, 20 feet high.

I also saw in the Hufuf oasis specimens of Indian trees such as the Indian Almond (*Terminalia Catappa* L.), the "Persian Lilac" (*Melia Azedarach* L.) and Castor Oil plant (*Ricinus communis* L.) growing as ornamental trees in rich men's gardens; also some common Willow Trees (*Salix*). The tall, graceful Tamarisk (*Tamarix macrocarpa*)—Arabic "Ithl"—40 feet in height, grows all over the oases of Hasa and Jabrin; the timber is used for building, is cut into planks for doors, and in Riyadh is made into bowls used by badawin for milk.

Also *Zizyphus Spina-Christi* Willd.—Arabic "Sidra" or "Nebuk"—big trees, 30 feet. It is planted by water lifts, where its spreading branches and thick leaves give shade to man and beast working on the pulleys. The dry, plum-like fruit is eaten. The various kinds of Dates grown in Hufuf are mentioned in a previous chapter.

Orange, Lemon and Citron trees and Pomegranate bushes flourish and are plentiful; Mulberry trees are not quite so numerous.

Vegetables seen.—Onions, transplanting seedlings November 20; a Spinach (Arabic "Silliq"), really a kind of Wurzel; Brinjal or Egg-plant (Arabic "Betinjan"), in flower and fruit throughout winter in sheltered gardens, which is not possible in Iraq owing to frosts; Ladies' Fingers (Arabic "Bamia"), also gathered throughout winter; Radishes—small, round, red radishes were first seen for sale December 23, and Carrots were also then in season. A small Bean like the Haricot (Arabic "Lobia") is grown in summer and stored for winter; I often ate it in hash.

I found no Saffron grown locally, but a quantity is sold in the bazaar in tins and is imported from Spain by an agent in Bombay. Saffron is used for flavouring coffee, and women stain their foreheads with it. European Saffron is manufactured from the yellow Crocus, for which flower the Persian name is "Zafa-

ran." Bastard Saffron is manufactured from a yellow Thistle-like plant, *Carthamus tinctorius*, of which there are specimens in the British Museum from Muscat.

Plants of Cotton were in flower and the bolls were bursting in December. The cotton was short-stapled and the fibre coarse, but it is not a fair time of year to criticise—it might be much better in the summer. The flowers were pale yellow, the petals pinkish at the edge; height of plant, 3 to 4 feet. Here and there an uneven row of plants is seen, but it is not grown with any system and the growth is not strong. Probably good Cotton could be grown with care, but the area that could be put under Cotton would be insufficient to make it worth while producing over local requirement. Most of the cultivated land is much shaded by palms and would get insufficient sun for a Cotton crop.

Huge Citrons were being gathered and were on sale in the bazaar on December 23. Oranges were gathered and all disposed of when I arrived on November 20.

Melon-beds were being sown January 31. The places selected were the most sheltered, where scanty palms gave the sun access to the ground.

List of eight Plants mentioned by the Al Murra guide as being found in the region of Magainma in the Al Rimal or in the centre of the Great Sand Desert.

Three names have been identified by the Arabic name in the Appendix to *The Heart of Arabia*.

Zahar : *Tribulus alatus* Del. (Zygophyllaceæ).

Andab : seen also in Jafura—a kind of drought-resisting grass.

Sabat : *Gramineæ* sp.

Jemin : ?

Hadh : *Salsola* sp. (Chenopodiaceæ).

Alqa : ?

Halab : ?

Birqan : ?

APPENDIX VII

GEOLOGICAL NOTES

Notes on Rocks collected by Major R. E. Cheesman in Central Arabia. By W. CAMPBELL SMITH, M.C., M.A.

MOST of the rocks collected by Major Cheesman are white sandy limestones, or rather calcareous sandstones, consisting of about 50 per cent. of very fine angular quartz-sand in an opaque chalky matrix. The actual proportion of quartz-sand no doubt varies from place to place. Some beds contain little pebbles nearly a quarter of an inch in diameter.

This white chalky sandstone appears first in the neighbourhood of Hufuf, and specimens were collected from Jabal Abu Ghanima and from Qara Hill, nine miles N.E. of Hufuf. Farther south it was found forming Jabal Harmaliya and Jabal Kharma Zarnuqa in the Jafura plain.

An exactly similar white calcareous sandstone appears again forming the top of Jabal Jabrin al Wasti, S.E. of Jabrin oasis, and apparently constitutes most of Jabal Jawamir too. Photographs of the outcrops taken by Major Cheesman show that the bedding is approximately horizontal. It is separated from the more northern outcrop by extensive gravel plains. Near Jabal Jawamir it appears to be underlain by sandy beds sometimes salt-bearing. For example, the material thrown out from a well-sinking one mile south of Jabal Jawamir is a grey friable sandstone, and at Jabal Jawamir itself there occur white and salmon-pink sands in which salt acts as a cement, making a hard stone which crumbles in water to a fine sand.

Unfortunately the limestone yielded no fossils except one specimen of an Astræid coral from Harmaliya plain, of which the original calcium carbonate has been replaced by chalcedony, a replacement which has almost entirely removed all trace of structure and has rendered the fossil quite unidentifiable.

In some respects the lithological characters of this chalky

sandstone might agree with G. E. Pilgrim's ¹ description of the white limestones of Bahrain Island, which are ascribed to the Eocene (Lutetian) period, and some support to this supposition is given by the presence on the Harmaliya plain of masses of chalcedony which may have weathered out of the limestone.

On the other hand, close comparisons can be made with the calcareous sandstones found by W. K. Loftus at Meshed Ali, near Bahr-i-Najaf, on the west of the Euphrates and placed by him in his Gypsiferous series; that is in the Fars series (Miocene) in Pilgrim's classification. Some specimens of Loftus's calcareous sandstones are in the British Museum collections, and the resemblance to Major Cheesman's rocks from Jabal Abu Ghanima is certainly very close. Unfortunately no specimens from Bahrain Island are available for comparison, and in the absence of fossils any attempt to suggest the horizon which these rocks represent is mere guess-work.

Mention was made above of wide gravel plains which separate the two limestone areas of Hufuf and Jabrin. The gravel extends from Harmaliya in the Jafura desert, across the plain of Saramid, and (south of Wadi Sahba) to the top of Jabal Aqula, beyond which the white chalky sandstones appear again.

A collection from any one locality contains several different kinds of pebbles, but at all the localities the same types are represented.

Most of the pebbles collected by Major Cheesman can be classified as follows in order of the abundance in his collection:

1. Compact buff-coloured limestones with some fine dendritic markings.
2. Quartz, for the most part white and opaque.
3. Pale green epidotised and silicified volcanic ashes.
4. Black banded rhyolites.
5. Blue-grey slaty rock, possibly an ash.
6. Jasper.
7. Very rarely fragments of (*a*) red quartz-porphry, and (*b*) very fine-grained granite.

The immediate source of these pebbles seems to be a conglomerate which is weathering down to gravel in places. A sandy, slightly calcareous conglomerate containing pebbles of

¹ Pilgrim (G. E.), "The Geology of the Persian Gulf and the adjoining portions of Persia and Arabia," *Memoirs of the Geological Survey of India*, Vol. XXXIV. Part 4, 1908.

limestone and quartz was found by Major Cheesman below the loose gravel of the Jafura desert. Another conglomerate with a hard white chalky matrix and abundant round flat pebbles of compact yellowish limestone was found in the bed of the Wadi Sahba: this contains water-worn pebbles of at least the first three types mentioned above. If an extensive bed of conglomerate underlies the gravel plains its weathering would readily supply the pebbles, the finer materials being carried away by wind and solution. We have no knowledge of the original source of the pebbles which went to form the conglomerate, but we may hazard again a guess at the age of the deposition of the conglomerate itself. In South-west Persia and in Iraq conglomerates are strongly developed, sometimes reaching a thickness of 1000 feet and characterised notably by pebbles of red and green chert and limestone. These conglomerates with some grit beds form the Bakhtiyari series of Pilgrim, believed to be of Pliocene age, and overlie unconformably the Fars series (Miocene). Loftus¹ observed these conglomerates on the Euphrates and placed them in the upper part of his Gypsiferous series. Unfortunately no samples of the conglomerates are preserved in his collection in the British Museum, but he has given an excellent record of the variety of pebbles found at these localities, and a comparison of his lists with the one given above shows a very close similarity.

At Iskanderia (Khan Iskandariyah), between Baghdad and Hilla, he recorded seventeen kinds of pebbles, of which we may mention :

- “ 1. White, reddish, yellowish and milk-white quartz.
6. Cherts of various colours, from grey to almost black.
7. Light green chert, approaching jade.
9. Jasper, chiefly red, and brown-veined.
10. Waxy indurated limestone, whitish, green, grey, blue-black, and black : some varieties approaching marble.
12. Flinty slate, from grey to black.
13. Granite of fine-grained variety : greenish-grey colour (very rare).”

Again at Akker Koof (Akkar Kuf), twelve miles N.W. of Baghdad, he gives the following account of the pebbles in a “gravel” there : “ the same pebbles as at Iskanderia, excepting those mentioned in the list as rare :

¹ Loftus (W. K.), *Quart. Journ. Geol. Soc.*, 1855, Vol. XI. pp. 256, 257.

“ In addition I collected there the following :

Pinkish granite, composed of quartz, feldspar, and oxide of iron (rare).

Porphyry (?) one.

Light-brown compact limestone with veins of serpentine.

Many quartz, jasper, chert, and limestone pebbles, flattened so as to be easily mistaken at first sight for coins.

“ The following is a rough percentage of the pebbles found at Iskanderia and Akker Koof :

Quartz, 30.

Chert, flint, and jasper, 40.

Limestone, sandstone, flinty slate, serpentine, porphyry (?), granite, nummulitic and coralline limestone, 30.”

Allowing for the possible identifications of the black rhyolites and bright green ashes as black and green chert, every kind of pebble collected by Major Cheesman in Jafura seems to be present also in the conglomerates described by Loftus in Iraq, and it seems quite possible that the Jafura conglomerates may belong to the Bakhtiyari series (Pliocene). If this is the case, the suggestion that the white chalky sandstones represent part of the Fars series becomes more probable, and we may imagine the conglomerate as possibly occupying a shallow syncline or depression and overlying the chalky sandstones which outcrop north and south of it.

Major Cheesman has mentioned the fact that he collected a solitary and much-weathered granite pebble from the sands thrown out of a well a mile south of Jabal Jawamir. It is a pink millimetre-grained granite rock, very much altered, veined with quartz, and impregnated with traces of manganese oxides. Its appearance quite alone in the sands is odd, but small pebbles derived from granitic rocks were found on the gravel plains and are recorded by Loftus in the conglomerates on the Euphrates, and we must attribute this bit of granite to a similar source to the gravel. In any case it seems much too poor a granite to have ever been used for building or decoration.

Mention must also be made of the many beautiful examples of Etched Pebbles—*Rillensteine* of some German authors—which here as in other desert areas are afforded by the limestone pebbles. Many of the limestone pebbles of all shapes and sizes are delicately furrowed by little solution-channels which

show every variation in shape, from almost straight ones to complicated forms recalling the convolutions of the human brain. It is noticeable that these furrow-patterns are only found on the limestone pebbles, and that they cover the entire surface of the stone even when it has been deeply embedded in sand. Some which have been exposed to the wind show how the wind-blown sand has commenced to polish away the edges of the furrows, and begun the development of the facetting so well known in the faceted-pebbles (*Dreikante*) of sandy deserts.

According to J. Walther, who has made a thorough study of desert conditions, etching of the limestone pebbles takes place in the soil where surface-solutions become concentrated. The etched pebbles are found to a depth of ten to twenty centimetres only. Gradually they work their way to the surface, where, unless exposed to wind-blown sand, they may retain their ornamented surfaces almost unimpaired for long periods.

LIST OF MAJOR CHEESMAN'S SPECIMENS

	Jabal Abu Ghanima, Hufuf.		White calcareous sandstone.
	Qara Hill, 9 miles N.E. of Hufuf.	23. xi. 23.	White calcareous sandstone.
5164.	16. Jabal Harmaliya.		White calcareous sandstone.
	8.		Silicified astræid coral.
	8. Harmaliya plain.	14. ii. 24.	
5165.	8.		Etched and wind- worn pebbles of limestone.
	10. Saramid plain.	15. ii. 24.	
			Wind-worn peb- bles. White quartz, "walk- ing stone."
	15. Bed of Wadi Sahba; 6 in. below sand of present bed.	15. ii. 24.	Sand with water- worn-pebbles.
	11. Jabal Aqula.	18. ii. 24.	Quartzite pebble from mud-brick of ruined castle.
	6. Jabal Jabrin al Was- ti, S.E. of Jabrin palm area. Loose rubble.	20. ii. 24.	White calcareous sandstone.

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|-------|-----|---|-------------|--|
| 5165. | 3. | Same place. <i>In situ</i> . | | White calcareous sandstone. |
| | 12. | Jabal Jawamir. | | White calcareous sandstone. |
| | 7. | Jawamir. Below calcareous sandstone. | | White and pink sand cemented with salt. |
| | 4. | Excavation for dead well one mile south of Jabal Jawamir, Jabrin. Near ruined castle. | | (1) Loose grey sand.
(2) Pebble of calcareous sandstone.
(3) Pebble of much-weathered fine-grained granite. |
| | 14. | Jabal Aqula, top. | 24. ii. 24. | Etched and wind-worn pebbles of various kinds. |
| | 13. | Bed of Wadi Sahba. | 25. ii. 24. | Hard white conglomerate with water-worn pebbles of limestone. |
| | 5. | Jafura desert. | 25. ii. 24. | (1) Small etched and wind-worn pebbles of various kinds.
(2) Large etched pebble of limestone.
(3) Nodule of pale-grey chalcedony. |
| | 9. | Jafura desert. | 26. ii. 24. | Friable conglomerate with water-worn pebbles. |
| | 2. | Jabal Kharma Zarnuqa. | 29. ii. 24. | White calcareous sandstone. |

APPENDIX VIII

METEOROLOGICAL RECORD

(Shade temperatures except where stated otherwise,
Fahrenheit.)

1923.			
17. xi.	Oqair.	Temp. at 3.50 p.m. G.M.T.,	72°. Bar. 30.2.
18. xi.	"	" at sunrise	60°, at local noon, 78°. Bar. 30.15.
22. xi.	Hufuf.	" at local noon	71°. Bar. 29.68.
24. xi.	"	" 1 hour after sunrise	69°, 3 hours after sunset 69°.
25. xi.	"	" at local noon	70°, in sun, same time, 84°.
27. xi.	"	" at sunrise	67°. Bar. 29.76.
28. xi.	"	" " 62°, at 8 p.m. local	64°.
29. xi.	"	" " 61°.	
1. xii.	"	" " 54°. Bar. 28.0.	
2. xii.	"	" " 60°.	
3. xii.	"	" at local noon	77°, in sun, same time, 92°.
6. xii.	"	" at sunrise	59°.
7. xii.	"	" " 66°. Bar. 29.64.	
9. xii.	"	" " 59°. Bar. 29.8.	
10. xii.	"	" at local noon	74°, in sun 85°.
12. xii.	"	" at sunrise	60°.
13. xii.	"	Bar. at 4.10 p.m. G.M.T.,	29.6.
14. xii.	"	Bar. 1 hour after sunset,	29.7.
15. xii.	"	Temp. at local noon	73°, in sun, same time, 85°.
18. xii.	"	" at sunrise	58°.
20. xii.	"	" at local noon	71°. Bar. 29.75.
21. xii.	"	" at sunrise	52°.
22. xii.	"	" " 51°.	
25. xii.	"	" at local noon	66°, at 8 p.m. local 65°.
26. xii.	"	" at sunrise	55°.
28. xii.	"	" " 50°. Bar. 29.8.	
1924.			
6. i.	"	" " 53°.	
8. i.	"	" " 54°.	
10. i.	"	" " 62°. Bar. 29.65.	
14. i.	"	" " 62°. Bar. 29.6.	

1924.					
15. i.	Hufuf.	Temp. at sunrise	55°.	Bar.	29.6.
16. i.	"	"	"	48°,	at local noon 64°.
17. i.	"	"	"	50°.	
18. i.	"	"	"	53°.	
19. i.	"	"	"	49°.	
20. i.	"	"	"	49°.	
21. i.	"	"	"	56°.	Bar. 29.7.
22. i.	"	"	"	56°.	Bar. 29.6.
23. i.	"	"	"	63°,	at local noon 74°.
					Bar. 29.5.
24. i.	"	"	"	63°.	Bar. 29.5.
25. i.	"	"	"	61°,	at local noon 72°.
					Bar. 29.7.
26. i.	"	"	"	57°.	
27. i.	"	"	"	59°,	at local noon 76°.
28. i.	"	"	"	62°.	
29. i.	"	"	"	64°.	Bar. at 7 p.m. local,
					29.55.
30. i.	"	"	"	63°,	at local noon 71°.
					Bar. 29.6.
31. i.	"	"	"	66°,	at 3 p.m. local 75°.
					Bar. 29.45.
1. ii.	"	"	"	58°.	
2. ii.	"	"	"	51°.	Bar. 29.6.
3. ii.	"	"	"	58°.	
4. ii.	"	"	"	53°.	Bar. 29.5.
5. ii.	"	"	"	52°,	at 3 p.m. local, 69°.
6. ii.	"	"	"	53°,	at sunset 61°,
					2 hours after sunset 57°,
					and same time in my room 62°.
7. ii.	"	"	"	47°,	at local noon 59°,
					noon in sun 77°.
8. ii.	"	"	"	46°.	Bar. 29.67.
10. ii.	Dalairiya.	Temp. at dawn	51°.	Bar.	29.5.
10. ii.	Zarnuqa.	Temp. at 1.15 G.M.T.,	81°.	Bar.	29.6.
11. ii.	"	"	at dawn 48°.	Temp. of sand 3 inches below surface at same time	54°.
					Bar. 29.6.
12. ii.	"	"	at sunrise	52°.	Bar. 29.7.
13. ii.	Janah Jafura.	Temp. at sunrise	42°.	Bar.	29.6.
13. ii.	Jabal Dharabin.	Temp. 1 hour after sunset	59°.	Bar.	29.55.

1924.			
14. ii.	Jabal Dharabin.	Temp. at sunrise	37°. Bar. 29.4.
15. ii.	Zaida Jafura.	At sunrise heavy white fog and dew.	Bar. 29.3.
15. ii.	Wadi Sahba.	Temp. 1 hour after sunset	70°. Bar. 29.38.
16. ii.	" "	" at sunrise	50°. Bar. 29.35.
16. ii.	Jabal Aqula.	" 1 hour after sunset	68°. Bar. 29.6.
17. ii.	" "	" at sunrise	45°. Bar. 29.5.
17. ii.	Jabrin.	Temp. at 11.15 G.M.T.	85°. Bar. 29.5.
18. ii.	" "	1 hour after sunrise	64°. Bar. 29.5.
18. ii.	" "	at 3 p.m. local	84°.
19. ii.	" "	1 hour after sunrise	59°. Bar. 29.47.
19. ii.	" "	at local noon	86°, in sun, same time, 111°.
20. ii.	" "	at sunrise	59°. Bar. 29.6.
21. ii.	" "	"	48°. Bar. 29.55.
22. ii.	" "	"	55°. Bar. 29.4.
22. ii.	" "	in tent at local noon	90°.
23. ii.	" "	at dawn	58°. Bar. 29.38.
23. ii.	Jabal Aqula.	Temp. at 1 p.m. G.M.T.	92°. Bar. 29.53.
24. ii.	" "	" at dawn	56°. Bar. 29.8.
24. ii.	Wadi Sahba.	" at 5 p.m. G.M.T.	77°. Bar. 29.3.
25. ii.	" "		Bar. 29.2.
26. ii.	Zaida Jafura.	Temp. at dawn	58°. Bar. 29.1.
26. ii.	Jabal Dharabin.	Temp. 2 hours after sunset	83°.
27. ii.	" "	" at dawn	63°. Bar. 29.45.
28. ii.	Zarnuqa.	Temp. at dawn 48°, at local noon 78°, in sun, same time,	101°. Bar. 29.6.
29. ii.	" "	at dawn	47°. Bar. 29.68.
1. iii.	Dalaiqiya.		Bar. 29.67.
2. iii.	Hufuf.	Temp. at dawn	65°. Bar. 29.58.
3. iii.	" "	at sunrise	60°. Bar. 29.5.
6. iii.	Oqair.	" at dawn	59°. Bar. 30.2.

ARABIC NAMES FOR STARS.

North Star, <i>Yedi</i> or <i>Jedi</i> .	Sirius, <i>Mirzam</i> .
Pleiades, <i>Dhraya</i> .	Canopus, <i>Sohail</i> .
Great Bear, <i>Bnat Thnash</i> .	Venus, <i>Zahra</i> .
Orion, <i>Mizan</i> (badawin, <i>foza</i>).	

APPENDIX IX

STORES

- Whetstone for knife and scalpel.
- Water-colour paint-box and sketch book for colour of fish and reptiles and flowers.
- 2 camel-hair paint-brushes.
- India-rubber.
- 1 ball of strong twine (3 better).
- Corkscrew.
- Screw-driver, large.
 - do. small for theodolite.
- Medicine chest, strong wooden box and rope handles; inside measure 16 in. × 10 × 6 deep; tight-fitting lid with strong iron hinges.
 - Castor-oil, big bottle.
 - Iodine, tincture of, $\frac{1}{4}$ -lb. bottle.
 - Permanganate of potash crystals.
 - Vaseline, 3 small bottles.
 - Camphorodyne—dose 15 drops.
 - Hypodermic syringe and formalin.
 - Eucalyptus oil.
 - 6 first-aid bandages— $2\frac{1}{2}$ inch, 6 yards—compressed.
 - Cotton wool.
 - 2 first field dressings.
 - 1 bottle Eno's Fruit Salts.
 - Zinc oxide in Eiffel Tower Lemonade bottle.
 - 100 aspirin tablets.
 - Iodoform powder in Eiffel Tower Lemonade bottle.
 - 100 quinine sulphate tablets (not enough, as in great demand; everywhere appreciated).
 - Small bottle brandy in Eiffel Tower Lemonade bottle.
- 2 ordinary bottles of brandy.
- 1 bottle of whisky.
- 3 small Bovril bottles.
- Boracic acid powder (forgotten and wanted).

- Tooth embrocation (forgotten and wanted).
 Clinical thermometer (forgotten and wanted).
 2 home-made flower presses of blotting-paper sheets—9 in. square and stiff cardboard back.
 Butterfly net. Cane weak near Y-piece, and cracked. I strengthened it with a strut from Y to top centre of net.
 Killing bottle.
 Entomological pins.
 Folding papers, greaseproof, for butterflies.
 Small packet naphthalene.
 Cork-lined box, 8 in. × 10 in.
 Taxidermy :—
 Tin box, 9 in. × 7 in. × 2½ in. high. Contains :
 ¼-lb. tobacco tin of arsenical soap.
 1 pencil stump.
 1 box stout brass pins.
 1 oil stove, small.
 1 reel, 200 yards, best six-cord cotton.
 1 needle.
 50 printed labels for skins.
 20 skull labels.
 1 pair big scissors.
 1 pair nail scissors, sharp points and best steel, English.
 1 pair steel champagne wire nippers.
 2 scalpels, or pocket knives.
 1 big skinning knife.
 1 file, flat.
 1 pair pointed tweezers.
 1 pair brass dividers.
 1 brass millimetre and inch scale—6 inches.
 1 big glue brush
 1 small paste brush } for arsenical soap.
 Few pieces of cotton wool.
 Few pieces of deal box wood for supporting skins.
 1 lb. arsenical soap in reserve.
 3 lbs. naphthalene, loose crystals.
 Packet needles.
 4 1-lb. rolls cotton wool.
 2 sizes tail wires.
 1 2-gallon screw-top petrol can containing 1 gallon methylated spirit.
 1 big-mouthed jar—10 inches high, mouth 3¾ inches wide.
 This was carried empty and used to soak specimens in spirit

for 2–3 days, after which they were removed and packed dry in cotton wool (big ones dried in the sun) and spirit returned to petrol tin. Tobacco tins used instead of jar for small specimens. On march specimens carried in jar in cotton.

·410 gun in canvas cover, with brass cleaning-rod.

300 ·410 cartridges loaded dust shot.

300 ·410 cartridges loaded 6 shot.

12-bore gun in hard gun-case, cleaning-rod and oil-bottle, with reserve of rifle oil.

300 12-bore cartridges loaded dust shot.

300 ditto, loaded 7 shot.

100 ditto, loaded 4 shot.

25 lethal (if gun-barrels non-choke).

25 12-bore No. 1 shot (forgotten, but needed for Eagles, Gazelle).

(The above is reckoned at 5 cartridges per gun per diem of expected duration of tour, divided equally between dust and No. 7 shot, and 20 per cent. of each in addition to be left at base as reserve. Packed in tin-lined boxes, with number and size of shot marked outside each.)

12 steel spring traps, rat size.

12 ditto, mouse size.

Supply of 2 or 3 dried cokernuts.—Note: 2 strong gins for Jackal and Wolf should be taken.

Camera:—

No. 3 ($\frac{1}{4}$ plate) Autographic Kodak Special. Zeiss Lens = $3\frac{1}{4} \times 4\frac{1}{4}$ films; the autographic pencil spliced and suspended by thread.

24 $3\frac{1}{4} \times 4\frac{1}{4}$ autographic Kodak films—6 exposures—packed in tins.

4 $3\frac{1}{4} \times 4\frac{1}{4}$ autographic Kodak films—12 exposures.

(Above dated to expire September 1924, or 11 months from commencement of journey.)

Theodolite box, 43 in. \times 11 in. by $6\frac{1}{2}$ in. deep, all inside measures, of $\frac{7}{8}$ in. deal. I had the screws removed from top on steamer and 2 hinges substituted, as screws for field work were impossible. Closed by a rope. Contains:

1 3-in. theodolite and stand.

1 hypsometrical apparatus; boiling-point apparatus in leather case, with 3 thermometers 0–140° F. and 2 of 180° to 215°.

1 aneroid barometer.

1 electric torch for star-work and 3 refills.

Nautical Almanack 1923 and 1924.

Field angle book—should be bound in colourless canvas.

1 bottle of methylated spirit for boiling-point apparatus.

Hints to Travellers, 2 vols. Computation forms E. and W. stars.

1 pocket chronometer, carried in my pocket always and wound night and morning.

1 prismatic compass, carried in pocket always.

1 stiff-backed note-book, leather bound, or canvas would be

better, 120 pages $4\frac{1}{4} \times 6\frac{1}{2}$, ruled | h. | m. || s. | ' | miles
Carried in pocket always. | | | | | per
| | | | | hour. |

1 Officer's Service haversack, large size, $13\frac{1}{2}$ in. deep, top of bag to bottom.

1 ditto small, 11 in. deep; useful for cartridges, but larger size most serviceable for cartridges, traps, specimens or kit.

2 Venesta boxes of latticed wood, tin-lined, with 6 trays of different depths—tray sides of wood and bottoms of cloth.

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