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THE

SOUTH AFRICAN JOURNAL

OF

NATURAL HISTORY

being
the official organ of the

SOUTH AFRICAN BIOLOGICAL SOCIETY

with which is incorporated the Journal of
The South African Ornithologists' Union.

EDITORS:

A. K. HAAGNER, I. B. POLE EVANS, CLAUDE FULLER.

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CONTENTS.

THE SOUTH AFRICAN BIOLOGICAL SOCIETY.

The South African Biological Society was provisionally formed in June 1916, but it was not until the following December that it was duly constituted as an independent organization with definite aims and objects. The Society may well be described as an amalgamation of the South African Ornithologists' Union and the Transvaal Biological Society enjoying the support of a number of naturalists previously unconnected with either of the amalgamating societies. Owing to the war, many members of the parent bodies have not had the opportunity of joining, but the Constitution makes provision for their admission at any subsequent date as Foundation Members. At present there are 132 members, and of this number 65 belonged to one or the other or both of the old societies.

The history of our Society dates from the moment when Mr. A. J. T. Janse began to advocate the foundation of a South African Entomological Society and it took a concrete form with the reasoned opposition thereto by Mr. A. K. Haagner. Mr. Haagner opposed the proposal only on the ground that there were already too many such societies in South Africa and proposed, as an alternative, that a new society should be created by the amalgamation of some of those in existence. More particularly he urged that the scope and activities of the South African Ornithologists' Union should be enlarged so as to embrace zoological matters in general.

Mr. Janse adopted the suggestion and from then onward became the chief mover in all matters appertaining to the creating of a new society, Mr. Haagner heartily co-operating by securing the support of the members of the South African Ornithologists' Union.

At this stage a definite suggestion was laid before the Transvaal Biological Society that the one Society should amalgamate with the other and so form the nucleus of the new Society. Later, on the representations of Dr. Breijer supported by other members of the Society, this was agreed to and a committee, comprising members of both Societies with Sir Arnold Theiler as President, was elected to arrange the terms of amalgamation. These agreed upon, the South African Biological Society came into existence considerably strengthened by the financial position of the Transvaal Biological Society and the activities of its members.

So far only one branch of the South African Biological Society has been formed. This is the old Transvaal Biological Society under a new name, of which Mr. D. Kehoe is President and Dr. E. C. N. van Hoepen and Mr. A. K. Haagner Vice-Presidents, with Mr. H. K. Munro as Honorary Secretary. The local Society holds regular monthly meetings, and at the time of writing five of these, with an average attendance of fifteen members at each, have taken place, and the following papers and demonstrations have been presented :—

Robinson, E. M.	Blood Smear Diagnosis. *(18 Jan. 1917.)*
van der Bijl, P. A.	Fomes applanatus and its effect on Black Iron-wood in South Africa. *(18 Jan. 1917.)*
Bedford, G. A. H.	Demonstration of some abnormal antennæ of Gastrophilus equi. *(15 Feb. 1917.)*
Fuller, C.	The Venation of Termite Wings. *(15 Feb. 1917.)*
Green, H. H.	Isolation and description of an organism which oxidises the arsenite of cattle dip to arsenate. *(15 Mar. 1917.)*
Roberts, A.	Exhibit of a Flycatcher from German East Africa. *(15 Mar. 1917.)*
Janse, A. J. T.	Demonstration of Moths collected at Karkloof, Natal. *(19 Apl. 1917.)*
Fuller, C.	Demonstration: The Genesis of a Termite's nest illustrated by six months old colonies of Termes (Odontotermes) angustatus and Termes (Microtermes) incertus. *(19 Apl. 1917.)*

COUNCIL, 1917.

President.—Dr. H. G. Breijer*.

Vice-Presidents.—E. C. Chubb, John Hewitt, Dr. R. Marloth, C. F. M. Swynnerton, Dr. E. Warren.

Councillors.—G. Arnold, Prof. J. W. Bews, Dr. Ethel Doidge*, J. C. Faure, J. S. Henkel, A. J. T. Janse*, D. Kehoe*, C. W. Mally, J. P. Murray.

Editorial Committee.—I. B. Pole Evans*, Claude Fuller*, A. K. Haagner*.

Honorary Secretary.—C. K. Brain*.

Honorary Treasurer.—Claude Fuller.

(The officials whose names are marked with an asterisk compose the Central Executive Committee of the Society.)

Roll of Honour.

H. J. Vipond, Captain, Coldstream Guards; B.A.; Member of the Transvaal Biological Society; Chief of the Division of Chemistry, Union Department of Agriculture. Killed in action somewhere in France, 1917.

Honorary Members Roll. No. I.

Allen, Dr. J. A., Amer. Mus. Nat. Hist., Washington, D.C., U.S.A.

Bucknill, Hon. J. A., Chief Justice, Singapore.

Hartert, Dr. E., Director, Tring Museum, Tring, Herts, England.

Hewitt, Dr. C. Gordon, Dominion Entomologist, Ottawa, Canada.

Howard, Dr. L. O., Chief, Bureau of Entomology, Washington, D.C., U.S.A.

Marshall, Dr. G. A. K., Director, Imperial Bureau of Entomology, Natural History Museum, London.

Ridgeway, Prof. R., care Amer. Mus. Nat. Hist., Washington, D.C., U.S.A.

Sclater, W. L., M.A., care Zoological Society, London.

Roll of Foundation Members. No. I.

Akerman, Conrad. M.A., M.B., B.C. Alexandra Road, Pietermaritzburg, Natal. (*Entomology.*)

Andrews, W. H. B.Sc., M.R.C.V.S. Div. Vet. Research, Union Dept. Agric., P.O. Box 593, Pretoria, Tvl.

Arnold, George. D.Sc., A.R.C.S., F.E.S. Curator, Rhodesian Museum, Bulawayo, Rhodesia. (*Entomology.*)
Desires to exchange Fossorial Hymenoptera and Formicidæ.

Baker, Ernest. B.Sc. Lect. in Botany, School of Agric., Union Dept. Agric., Cedara, Natal.

Barker, Cecil Newton. F.E.S. 244 Essenwood Road, Durban, Natal. (*Entomology.*)
Desires to exchange South African Coleoptera.

Bedford, G. A. H. F.E.S. Div. Vet. Research, Union Dept. Agric., P.O. Box 593, Pretoria, Tvl. (*Entomology.*)

Bell-Marley, H. W. P.O. Box 3, Point, Natal. (*Coleoptera and Oology.*)
Desires to exchange birds' eggs.

Bennett, Miss Catherine E. Normal College, Pretoria, Tvl. (*Botany.*)

Bews, Professor John W. M.A., D.Sc. Professor of Botany, Natal University College, Pietermaritzburg, Natal. (*Plant Ecology.*)
Desires to exchange Ecological papers of all kinds.

Bishoff, L. Division of Chemistry, Union Dept. Agric., Pretoria, Tvl.

Bok, Willem Eduard. (LL.D. Leiden), Barrister-at-Law, Middle Temple. Legal Adviser, Department of Justice, Pretoria, Tvl.

Bottomley, Miss Averil Maud. B.A. Div. Botany, Union Dept. Agric., P.O. Box 1294, Pretoria, Tvl. (*Botany and Natural History.*)

Bottomley, Mrs. G. A. 220 Johann Street, Pretoria, Tvl. (*Botany, History, Natural History.*)

Brain, C. K. M.Sc. (Birm.), M.A. (O.S.U.). Div. Entomology, Union Dept. Agric., P.O. Box 513, Pretoria, Tvl. (*Coccidæ.*)

BREIJER, Dr. H. G. Director, Transvaal Museum, P.O. Box 413, Pretoria, Tvl.

BRUMMER, B. J. M.R.C.V.S. Govt. Vet. Surg., Union Dept. Agric. Marine Bungalow, Acutt Street, Durban, Natal.

BUNTINE, R. A. B.M. (M.L.A.). Pietermaritz Street, Pietermaritzburg, Natal.

BURNUP, HENRY CLIFDEN. P.O. Box 182, Pietermaritzburg, Natal. (*Mollusca.*)
Desires to exchange S. African Mollusca in good condition.

BURTT-DAVY, JOSEPH. F.L.S., F.R.S. (S.A.), F.R.C.I. Burttholm, Vereeniging, Transvaal.

CALDECOTT, WILLIAM ARTHUR. B.Sc. (C. G. H. Univ.). Consulting Metallurgist. P.O. Box 67, Johannesburg, Tvl.

CHALMERS, JAMES. M.R.C.V.S., F.V.M.A. Govt. Vet. Surg., Union Dept. Agric., P.O. Box 44, Piet Retief, Tvl.

CHUBB, ERNEST CHARLES. F.Z.S., F.E.S. Curator of Durban Museum, Durban, Natal. (*Zoology, especially Mammalogy and Ornithology.*)

CLARK, E. L. 345 Smith Street, Durban, Natal.

COGAN, ERIC. Ph.D. Lect. in Entomology, School of Agric., Union Dept. Agric., Cedara, Natal.

COLE-HAMILTON, GEORGE WILLIAM. B.A. Cantab. Gortin, Coalbrook, Orange Free State.

CORYNDON, ROBERT THORNE. C.M.G. Resident Commissioner, Maseru, Basutoland. (*Game animals of S. Africa.*)

DE CHARREY, Miss B. M. H. Normal College, Pretoria, Tvl.

DE KOCK, GILLES V. D. WALL. Div. Vet. Research, Union Dept. Agric., P.O. Box 593, Pretoria, Tvl.

DE VILLIERS, Hon. JACOB. Judge President, Supreme Court, Pretoria, Tvl.

DE VILLIERS, TIELMAN NIEUWOUDT. Belle Ombre, Pretoria, Tvl.

DOD, T. C. WOLLEY. 351 Hill Street, Pretoria, Tvl.

DODT, JOSEPH. Custodian, O. F. S. Museum, Bloemfontein, Orange Free State.

DOIDGE, ETHEL M. D.Sc., M.A., F.L.S. Div. Botany, Union Dept. Agric., P.O. Box 1234, Pretoria, Tvl.

DUERDEN, JAMES EDWIN. M.Sc., Ph.D., A.R.C.S. Professor of Zoology, Rhodes University College, Grahamstown. Officer in charge, Ostrich Investigations, Grootfontein School of Agriculture, Middelburg, Cape Province.

EADIE, DUNCAN M. 318 Smith Street, Durban, Natal. (*Microscopic work.*)

ENGELENBERG, Dr. F. V. P.O. Box 389, Pretoria, Tvl.

EVANS, MAURICE SMETHURST. C.M.G. Hillcrest, Berea, Durban, Natal. (*Botany, Ethnology.*)

FAURE, J. C. M.A. Div. Entomology, Union Dept. Agric., P.O. Box 502, Bloemfontein, Orange Free State.

FINCH-DAVIES, CLAUDE GILENEY. Lieutenant, 1st S.A.M.R., Tsumeb, S.W. Africa Protectorate. (*Ornithology.*)
Desires to exchange specimens of birds from S.W.A. for specimens of S. African birds of prey. Would also be glad of the loan of specimens of certain species in order to figure them as he has for some years been preparing a series of plates of S. African birds of prey in all stages of plumage.

FITZSIMONS, F. W. F.Z.S., F.R.M.S., etc. Director, Museum, Port Elizabeth, Cape Province.

FLOYD, Mrs. F. Krantzkloof, Natal.

FULLER, CLAUDE. Div. Entomology, Union Dept. Agric., P.O. Box 513, Pretoria, Tvl. (*Termitidæ.*)

GILCHRIST, JOHN DOW FISHER. M.A., D.Sc., Ph.D. Professor of Zoology, S.A. College, Cape Town. (*Marine Zoology.*)

GODFREY, Rev. ROBERT. M.A.(Edin.). Missionary of the United Free Church of Scotland, Somnerville, Isolo, Cape Province. (*Ornithology and False Scorpions.*)

GREEN, HENRY HAMILTON. D.Sc., F.C.S. Div. Vet. Research, Union Dept. Agric., P.O. Box 593, Pretoria, Tvl.

GUNN, DAVID. Div. Entomology, Union Dept. Agric., P.O. Box 513, Pretoria, Tvl.

GYDE, CYRIL ERNEST. P.O. Box 446, Pretoria, Tvl. (*Theosophy and kindred subjects.*)

HAAGNER, A. K. Director, Nat. Zool. Gardens, P.O. Box 754, Pretoria, Tvl. (*Zoology, especially Ornithology & Mammalogy.*)

HAINES, GEORGE CLARK. M.Sc. Div. Entomology, Union Dept. Agric., New Hanover, Natal. (*Entomology.*)

HARDENBERG, CHRISTIAN BERNHARDUS. B.A., M.A. Maroelapan 801, P.O. Rita, *via* Pietersburg, Tvl. (*General Entomology, especially parasitic Hymenoptera, immature stages of Lepidoptera.*)

Desires to exchange Bagworms, Parasitic Hymenoptera.

HARGREAVES, (Mrs.) DOROTHY BLANCHE. Krantzkloof, Natal. (*Entomology.*)

HARGREAVES, LIONEL. Krantzkloof, Natal. (*Entomology.*)

Desires to exchange Natal and Zululand species for those from the Transvaal and Cape Colony.

HATCHARD, Miss JOAN ETHEL MARY. Girls' High School, Bloemfontein, Orange Free State. (*Zoology.*)

HAYCROFT, JOHN CHARLES. Public Works Department, P.O. Box 384, Pietermaritzburg, Natal. (*Botany and Entomology.*)

HENKEL, JOHN S. Conservator of Forests, 59 Loop Street, Pietermaritzburg, Natal.

HEWITT, JOHN. B.A. (Cantab.). Director of Albany Museum, Grahamstown, Cape Province. (*Arachnida, Reptilia and Amphibia.*)

ILLINGWORTH, EDMUND LEOPOLD. Byram, Umfolozi, Zululand.

INGLE, JOHN CLIFTON, Capt. F.Z.S. The Wilderness, P.O. Graskop, Transvaal. (*Big Game especially and all game animals and Natural History.*)

JACK, RUPERT WELLSTOOD. Government Entomologist, Salisbury, Southern Rhodesia. (*Economic Entomology.*)

JANSE, ANTONIUS JOHANNES THEODORUS. Lecturer in Biology, Normal College, Pretoria, Tvl. (*S.A. Heterocera*; *Pyralidæ of the world.*)

Desires exchanges in any of the above groups.

JOHNSON, KENNETH COWPER. Westminster, Orange Free State. (*Ornithology.*)

KEHOE, DAVID. M.R.C.V.S. Div. Vet. Research, Union Dept. Agric., P.O. Box 593, Pretoria, Tvl.

KELLY, THOMAS A. Land Bank, Pretoria, Tvl.

KENDALL, Miss IRENE A. Girls' High School, Pretoria, Tvl.

KING, HENRY WILLIAM ROBERT. Div. Vet. Research, Union Dept. Agric., P.O. Box 593, Pretoria, Tvl.

KIRBY, FREDERICK VAUGHAN. F.Z.S. Game Conservator, Nongoma, Zululand. (*Zoology.*)

KIRBY, WILLIAM. Waterworks Mid Station, Kimberley, Cape Province.

KROEGER, FRANZ JOSEF. Maboki, P.O. Acornhoek, Selati Line, Transvaal. (*Entomology.*)

LAWRENCE, FREDERICK JAMES. Magistrate, Tulbagh, Cape Province. (*Birds, Botany, Geology, and Astronomy.*)

LEGAT, CHARLES EDWARD. B.Sc. Agric. Edin. Chief Conservator of Forests, Union of South Africa, Pretoria, Tvl. (*Forestry.*)

LLOYD, ARTHUR. P.O. Box 470, Durban, Natal.

LOUNSBURY, CHARLES PUGSLEY. B.Sc. Mass. Agr. College & Boston (U.S.A.) University. Div. Entomology, Union Dept. Agric., Pretoria, Tvl.

MACFADYEN, WILLIAM ALLISON. M.A., LL.D. Transvaal University College, Pretoria, Tvl.

MACKAY, J. G. L.R.C.P. & S., L.F.P. & S. Umgeni Rd., Durban, Natal.

MAGGS, CHARLES. P.O. Box 291, Pretoria, Tvl.

MALLY, CHARLES W. M.Sc., F.L.S. Div. Entomology, Union Dept. Agric. Pine Grove, Glebe Rd., Rondebosch, Cape Province.

MARLOTH, RUDOLF. Ph.D., M.A. P.O. Box 369, Cape Town. (*Botany.*)

MASTERSON, B. A. (Senr.). King Street, Humansdorp, Cape Province.

MELCK, GILBERT HENRY. M.R.C.V.S. Govt. Vet. Surg., Union Dept. Agric., Umtata, Cape Province. (*Veterinary Science and Agriculture.*)

MERCEE, W. H. Cato Ridge, Natal.

MITCHELL, D. T. M.R.C.V.S. Govt. Vet. Surg., Union Dept. Agric., P.O. Box 405, Pietermaritzburg, Natal.

MORRISON, CHARLES WILLIAM. 578 Ridge Road, Durban. (*Diurnal Lepidoptera.*)

Desires to exchange butterflies peculiar to Karroo and Western Province of Cape.

MÖRS, F. E. C. de Kroon, P.O. Brits, Transvaal. (*Ornithology.*)

MUNRO, HUGH KENNETH. Div. Entomology, Union Dept. Agric., P.O. Box 513, Pretoria, Tvl. (*Diptera.*)

Desires to exchange Diptera for any other insects.

MURRAY, JOHN PEARS. Asst. Commissioner, Mafeteng, Basutoland.

NOOMÉ, F. C. Taxidermist, Transvaal Museum, Pretoria, Tvl.

OBERHOLSER, HARRY CHURCH. A.B., M.B., Ph.D. Ornithologist, U.S. Nat. Museum, Washington, D.C., U.S.A. (*Birds of the world; Zoogeography.*)

O'NEIL, Rev. JOSEPH A., S.J. P.O. Box 54, Salisbury, Rhodesia.

ORPEN, JOSEPH MILLORD. 43 St. Marks Road, East London. (*History of South Africa.*)

Desires exchanges—Anthropology, Biology, etc.

OTTO, VAN. Stonehenge, Riet Vlei, *via* Mooi River, Natal.

PENNINGTON, Rev. Archdeacon G. E. The Vicarage, Greytown, Natal.

PETTEY, FRANKLIN WILLIAM. B.A. Maine, U.S.A. Lecturer in Entomology, Elsenburg Agric. School, Union Dept. Agric., Mulders Vlei, Cape. (*Psyllidæ.*)

Desires to exchange adult Psyllids.

PIENAAR, P. J. Div. Botany, Union Dept. Agric., P.O. Box 1294, Pretoria, Tvl.

PLATT, ERNEST EDWARD. F.E.S. 403 Essenwood Rd., Durban, Natal.

POLE EVANS, I. B. M.A., F.L.S. Div. Botany, Union Dept. Agric., Pretoria, Tvl.

PORTER, A. S. P.O. Box 708, Pretoria, Tvl.

POUTSMA, H. J. P.O. Box 1026, Pretoria, Tvl.

PURVIS, GEORGE CARRINGTON. M.B., M.D., B.Sc. M. O. H. for Grahamstown, C.P. (*Botany, Zoology, Geology, and Public Health.*)

Has a few papers in Zoology and Histology which he could exchange with others.

REDFERN, ARTHUR WILLIAM. Asst. Master of the High Court, Salisbury, Rhodesia. (*Lepidoptera.*)

RICH, STEPHEN GOTTHEIL. B.Sc. (New York). M.A. (Cornell). Amanzimtoti Institute, Natal. (*Odonata and other Pseudoneuroptera.*)

Desires to exchange Odonata of S. Africa.

RITCHIE, Miss MARY. Ainsdale, Congella, Durban.

ROBERTSON, COLIN CHARLES. M.F. (Yale). Research Officer, Forest Department, Pretoria, Tvl. (*Forestry, Botany, Entomology, etc.*)

ROBINSON, E. M. M.R.C.V.S. Div. Vet. Research, Union Dept. Agric., P.O. Box 593, Pretoria, Tvl.

ROBSON, THOMAS CONYERS. F.R.G.S., F.R.S.A. Booysens Central School, Johannesburg, Tvl.

ROOTH, ED. (M. L. A.). c/o P.O. Box 208, Pretoria, Tvl.

SCHLUPP, WILLIAM FRANCIS. B.Sc., Ohio State Univ. Lecturer in Zoology and Entomology, School of Agric. Union Dept. Agric., Potchefstroom. (*General Economic Entomology.*)

SCHOCH, H. G. Surveyor General, Pretoria, Tvl.

SCHÖNLAND, SELMAR. Ph.D., Hon. M.A. Oxon. Professor in Botany, Rhodes University College, and Supt. of the Herbarium of the Albany Museum. (*Botany generally, but especially the Phanerogamic Flora of S. Africa.*)

Desires to exchange S. African plants, determined species.

SIM, THOMAS ROBERTSON. F.L.S., etc. 168 Burger Street, Pietermaritzburg, Natal. (*Trees, Ferns, and Mosses.*)

Desires to exchange S. African Mosses to show distribution. Unnamed specimens accepted and named. Ferns.

SKAIFE, SIDNEY HAROLD. B.A. Div. Entomology, Union Dept. Agric., Rosebank, Capetown. (*Bruchidæ.*)

Desires to exchange Bruchidæ and seeds of Leguminosæ.

SKEA, ERNEST MARCELLUS. Chief Analyst, Transvaal Gold-Mining Estates, Pilgrims Rest, Transvaal. (*Ornithology.*)

SMITH, F. B. Secretary for Agriculture, Union of S. Africa, Pretoria, Tvl.

SMITH, CHARLES GEORGE, J.P. High Gate, South Ridge Rd., Durban, Natal.

SOFF, FRANS. P.O. Box 17, Pretoria, Tvl.

SPARROW, RICHARD. C.M.G., F.Z.S., F.R.G.S., M.B.O.U. Lt.-Colonel Comdg. 7th (Princess Royal) Dragoon Gds. Rookwoods, Sible Hedingham, Essex, England. (*Ornithology, Oology, Zoology, Big Game Shooting and Fishing.*)

Desires to exchange eggs of Transvaal Bush Veld birds: can offer Indian and British eggs in exchange.

SPRUYS, P. J. P.O. Box 259, Pretoria, Tvl.

STOTT, CLEMENT HORNER. F.G.S., M.S.A. P.O. Box 7, Pietermaritzburg, Natal. (*Geology.*)

SWIERSTRA, C. J. Entomologist, Transvaal Museum. P.O. Box 413, Pretoria, Tvl.

SWYNNERTON, CHARLES FRANCIS MASSY. C.M.B.O.U., F.L.S., F.E.S., F.R.H.S. Gungunyana, Melsetter, S. Rhodesia. (*Food of birds; adaptation (especially defensive and of coloration) in animals and plants; Rhodesian timbers and economic plants.*)

Desires good evidence for or against the existence of preferences in the eaters of birds' eggs; including witnessed refusals of particular eggs.

SYMONS, RODEN EDWARD. Game Conservator, Natal and Zululand. (*Ornithology.*)

Desires to exchange S. African birds and eggs.

THEILER, Sir ARNOLD. K.C.M.G., M.D., D.Sc., etc. Director of Veterinary Research, Union Dept. Agric., P.O. Box 593, Pretoria, Tvl. (*Helminthology.*)

Desires to exchange Helminths in general.

THOMPSON, Capt. L. C. M.R.C.S., L.R.C.P. Grootfontein, S.W. African Protectorate.

THOMPSON, R. LOWE. B.A., F.R.G.S. Department of Agriculture, Salisbury, Rhodesia. (*Entomology.*)

TREGARTHEN, WILLIAM COULSON. Mus.Bac.T.C.T., F.R.C.I., M.R.S.S.A. (Gold Medalist). The Hermitage, Queenstown, Cape Province. (*Biology.*)

VAN DER BIJL, PAUL ANDRIES. M.A., D.Sc., F.L.S. Div. Botany, Union Dept. Agric., Natal Herbarium, Berea, Durban, Natal.

VAN DER MERWE, CHRISTIAAN PIETER. Div. Entomology, Union Dept. Agric., Point, Durban. (*Entomology.*)

VAN HOEPEN, Dr. E. C. N. Transvaal Museum, P.O. Box 413, Pretoria, Tvl. (*Palæontology.*)

VEGLIA, Dr. F. Div. Vet. Research, Union Dept. Agric., P.O. Box 593, Pretoria, Tvl.

WAGNER, Dr. L. H. P.O. Box 259, Pretoria, Tvl.

WARREN, ERNEST. D.Sc. (Lond.). Director, Natal Museum, Pietermaritzburg, Natal.

WOLHUTER, H. Mtimba, Sabi Game Reserve, P.O. White River, Transvaal.

WOOD, JOHN. P.O. Box 363, East London, Cape Province. (*Ornithology and Anthropology.*)

SOUTH AFRICAN BIOLOGICAL SOCIETY.

Constitution.

I. Name.

The short title of the Society shall be "The South African Biological Society." The full title shall be "The South African Biological Society in which are incorporated the Transvaal Biological Society and the South African Ornithologists' Union."

II. Objects.

The objects of the Society are:—

(*a*) To advance the study of biological science and to give all possible assistance to those in South Africa who are interested in the study of natural history.

(*b*) To publish a journal of biology and natural history together with the transactions of the Society.

(*c*) To advocate the preservation of the monuments of nature.

(*d*) To hold scientific congresses from time to time in various centres.

III. Members.

The Society shall consist of Foundation, Ordinary, Life, and Honorary Members. Ordinarily all members shall be entitled to receive without charge one copy of the Society's publications and ordinarily all, except Honorary Members, shall be entitled to one vote in the deliberations of the Society.

IV. Council.

The Council shall consist of a President, at least four Vice-Presidents, an Executive Committee, an Editorial Committee, an Honorary Treasurer and an Honorary Secretary, and shall be proportionately representative of the members resident in the several Provinces and Territories of South Africa.

V. Annual Subscription.

The Annual Subscription shall be £1 payable in advance.

VI. Membership.

(*a*) Foundation members shall be exempt from any entrance fee and all members who joined the Society prior to October 1917 shall be enrolled as such. All members of the Transvaal Biological Society and South African Ornithologists' Union at the time of incorporation shall be entitled to be enrolled as Foundation Members without election upon paying their contribution for the year current wherein they apply for enrolment.

(*b*) Ordinary members shall be such as are duly elected and shall be entitled to all privileges upon paying their contributions.

(*c*) Life members: All who may become members of the Society may at any time compound their annual subscription by paying at once the sum of ten guineas. The number of life memberships shall, however, be strictly limited to 10 in all at any given time.

(*d*) Honorary members: Any person of special scientific attainments, not resident in South Africa, shall be eligible for election as an Honorary Member. Honorary Members shall be nominated by the Council and duly elected by Correspondence Ballot. The number of Honorary Members shall be strictly limited to fifteen at any given time. Such members shall be exempted from all contributions and shall receive the publications of the Society without charge, but they shall not be entitled to any vote in the deliberations of the Society.

VII. Election of Members.

All candidates for Ordinary Membership shall be proposed and seconded in writing, by two members of the Society. All nominations are to be submitted through the Honorary Secretary, and the candidates, when elected, shall pay an entrance fee of 10*s.* 6*d.* together with the annual subscription of £1; any member who may have been on active service at the time of the inauguration of the Society shall, however, be exempted from the payment of an entrance fee.

VIII. Election of Council.

(*a*) The Council of the Society shall be the Council at the time of the adoption of this Constitution and shall hold office during the year 1917.

(*b*) Any member of the Society, resident in South Africa, shall be eligible for election to any office.

(*c*) The election shall be held in December of each year and shall be conducted by a Correspondence Baliot.

(*d*) Every member whose residence is known shall, except as provided in III., VI. (*d*) and XII., have due notice by post of the election.

(*e*) The President and Council at the time being, having called for nominations by members, shall two months prior to the date of the election recommend to the members of the Society the officers for the ensuing year.

(*f*) All office-bearers shall retire annually, but shall be eligible for re-election.

(*g*) The Editorial Committee shall consist of three members of Council resident at the seat of the Society and shall hold office for a period of one year, after which they shall retire, but shall be elegible for re-election.

(*h*) The Executive Committee shall consist of all members of Council who reside at the seat of the Society. The President of the Society, if resident at the seat of the Society, shall be *ipso facto* Chairman of the Executive Committee, and if the President be not a resident the Vice-President so resident shall be the Chairman.

(*i*) In the event of any vacancy occurring in the Council the remaining members of the Executive Committee shall appoint a member of the Society to fill such vacancy.

IX. Seat of the Society.

The seat or headquarters of the Society shall be in Pretoria, subject only to the provisions of XVI.

X. Control and Management.

(*a*) The affairs, funds and the issue of the publications of the Society shall be controlled and directed by the Council. All voting by the Council shall, ordinarily, take place by Correspondence Ballot and the decision of the majority shall prevail.

(*b*) The general management of the affairs of the Society, the election of Ordinary Members; the essential arrangements for the issue of publications, notices, etc., shall be vested in the Executive Committee. At all meetings of the Executive Committee *five* shall form a quorum.

(*c*) The Council may delegate such other powers and functions to the Executive Committee as may be deemed expedient and necessary.

(*d*) At the close of each year of the Society, the Council shall present a report and balance-sheet for the information of all members.

(*e*) The Council may at any opportune time call Members together for congress or special meetings.

(*f*) The Council may at any time promulgate rules and bye-laws not in conflict with the provisions of this Constitution for the better government of the Society, formation of local branches and for affiliation with other Societies. Such rules and bye-laws shall have full effect provided (1) that each member of the Society receives one month's notice of the same, and (2) that not more than one-third of the members take exception thereto in writing prior to the proposed date of promulgation.

XI. The Society Year.

For financial purposes the year of the Society shall close on the thirtieth day of September and all annual subscriptions for the ensuing year shall be considered as due and payable on or before the first day of October in each year.

XII. Suspension of Members.

If any member after notice sent by post to his address in December and again in February shall fail to pay his annual contribution before the first day in March such member shall be suspended and continue to be suspended until the sum due be paid. Provided always that such member may be reinstated in his membership upon the recommendation of the Council.

XIII. Property of the Society.

The whole of the property of the Society shall be vested in the Council for the time being. A catalogue of all exchanges shall be kept and a stock list of any effects.

XIV. Local Branches.

Should the members of the Society resident at any centre desire to do so, they may form a branch or club of the Society for the purpose of holding monthly meetings, the reading of papers and scientific excursions. The Rules and Bye-laws of any such local branch when formed shall be subject to the approval of the Executive of the Society and shall not operate until such approval has been secured. The President of any Local Branch comprising not less than 20 members shall be *ipso facto* a vice-president of the Society. All local branches comprising not less than 20 members shall be entitled to receive from the funds of the Society a sum not exceeding £5 per annum to cover any expenses incurred in the calling and holding of monthly meetings. In regard to branches having less than 20 members, the amount shall be in proportion to the number of members.

XV. Affiliations and Incorporations.

Any scientific society in South Africa may at any time affiliate or become incorporated with the S. A. B. S. The terms of such affiliation or incorporation shall be arranged between the councils of the two societies and take effect when approved of by a majority of members in the case of each society.

XVI. Alteration of Constitution.

For the amendment, repeal or substitution of any of the foregoing provisions or for the making of any further provision to the Constitution the following procedure shall have effect:—

(1) All notices shall be in writing and supported by the signature of at least six members.

(2) Such notices shall be addressed to the Honorary Secretary, who shall submit a copy thereof to each Member of Council.

(3) The Council shall then submit the proposal to members by Correspondence Ballot, and if agreed to by two-thirds of the members such alteration shall be recorded in the book of Constitution and when so recorded shall have and take effect.

THE SOUTH AFRICAN ORNITHOLOGISTS' UNION.

THE idea of founding an Ornithologists' Union in South Africa originated with Mr. A. K. Haagner, now Director of the National Zoological Gardens, Pretoria. He corresponded on the subject with Mr. W. L. Sclater, then Director, South African Museum, Cape Town, Mr. J. Bucknill, then Commissioner of Patents, Pretoria, and Dr. Gunning, then Director of the Transvaal Museum, Pretoria, as well as with some thirty-five others. All signified their willingness to join such an organisation, if started. Advantage was taken of a Congress of the South African Association for the Advancement of Science in Johannesburg and, on the 8th April 1904, a meeting was held in the Normal College there, when the Union was formally launched. From those present a committee, consisting of Messrs. W. L. Sclater, J. Bucknill, J. A. Alexander, F. J. Ellemor, A. K. Haagner, and Dr. Gunning, was elected "to frame rules and decide upon publishing a Journal." The rules were duly formulated and a decision to publish a Journal arrived at. In July 1905 the first number appeared, containing 38 pages and 3 plates. Mr. Sclater was the first President of the Union and Mr. Haagner the first Hon. Secretary, a position he has occupied for thirteen years past. Mr. Bucknill was the first Editor in Chief; and, on his departure in 1907, this work was taken over by Mr. Haagner and with it he is still associated. The Journal was published at more or less regular intervals until the outbreak of the European war, when, chiefly owing to the departure of many of the active workers, it became exceedingly difficult to obtain material for publication. Twenty-two numbers of the "Journal" and three numbers of the "Bulletin" were published, during the eleven years. The papers are too many to enumerate, but much solid work was put in by many members and much original matter published, together with a number of coloured and other plates. The membership rose from thirty-nine at the inaugural meeting to one hundred and fourteen in 1910, and dropped to ninety in 1914. The Union has lost several strong supporters by death, notably Dr. Gunning, A. D. Millar, Dr. Symonds, and Lt.-Col. Horsbrugh.

The past Presidents of the South African Ornithologists' Union, in addition to Mr. Sclater, were Mr. Bucknill, Dr. J. E. Duerden, Dr. J. W. B. Gunning, Dr. L. Peringuey, and Sir A. Theiler.

THE TRANSVAAL BIOLOGICAL SOCIETY.

THE Transvaal Biological Society was founded in the latter part of 1907 and amalgamated with the South African Ornithologists' Union just nine years later to form the present South African Biological Society. In the course of its existence 61 regular and a number of extraordinary meetings were held. Before these, approximately 103 papers were read and numerous demonstrations were also given. A list of the principal papers and demonstrations is appended. At the time of amalgamation there were 47 members.

The Society was inaugurated at a meeting held in Pretoria on the 9th December, 1907. This meeting was presided over by Dr. (now Sir) Arnold Theiler; the following gentlemen were also present:—Drs. J. W. B. Gunning and W. Frei, Messrs. I. B. Pole Evans, A. J. T. Janse, J. Burtt-Davy, C. W. Howard, A. G. Mundy, R. A. Davis, as well as Miss R. Leendertz.

At a meeting held in the January following a constitution was considered and adopted and the following names placed upon the roll of Foundation Members:

Dr. A. Theiler, C.M.G.; C. E. Gray; J. Burtt-Davy; Dr. J. W. B. Gunning; H. Ingle; Jas. Walker; J. D. Watt; and A. J. T. Janse.

The past Presidents of the Society were:

Dr. Arnold Theiler (1908).
C. E. Gray (1909).
Dr. J. W. B. Gunning (1910).
I. B. Pole Evans (1911).
C. B. Hardenberg (1912).
Dr. J. W. B. Gunning (1913).
D. Kehoe (1914).
A. J. T. Janse (1915).
H. H. Green (1916).

Papers and Demonstrations.

BEDFORD, G. A. H.

The genus Gastrophagus. Read 18 Mar. 1913.

The genus Culicoides. Read 16 July 1914.

The Sheep Maggot-fly. Read 16 July 1914.

Experiments with Psoroptes communis. Read 27 Jan. 1916.

BRAIN, C. K.

Reproduction in the Monophlebinæ. Read 18 May 1916.

BREIJER, Dr. H. G.

An account of the Transvaal Museum expedition to the Maputa River. Read 19 Nov. 1914.

BURTT-DAVY, J.

Some additions to the Transvaal Flora. Read 17 Jan. 1908.

Notes on Drabok Poisoning. Read 17 Jan. 1908.

On the application of Mendel's Law of Heredity in the breeding of Maize. Read 17 Jan. 1908.

The Generic Names of S. African Plants, retained under Article 20 of the Vienna Rules of Botanical Nomenclature. Read 13 Apl. 1908.

Notes on the genus Callitris. Read 13 Apl. 1908.

Review of the Botanical features of Mr. T. R. Sim's "The Forests and Forest Flora of Cape Colony." Read 13 Apl. 1908.

Notes on Jatropha curcas, the Physic-nut. Read 13 Apl. 1908.

Uses of the seeds of Trichilia emetica. Read 13 Apl. 1908.

Further additions to the Transvaal Flora. Read 13 Apl. 1908.

Note on incomplete dichogamy in Zea mays. Read 8 Feb. 1909.

Notes on new or noteworthy Transvaal Plants. Read 15 June 1909.

Exhibition: Some photographs of fruit of the Grapple-plant extracted from the mouth of a cow. 12 July 1910.

On the Morphology of Maize. Read 12 July 1910.

On the occurrence of Crotalaria in different localities in the Transvaal.

BURTT-DAVY, J. (*cont.*).

Comparative Notes on the Flora of the Lamziekte area. Read 17 Oct. 1911.

DOIDGE, Dr. ETHEL.

Notes on Caralluma lutea, with exhibition of specimens. Read 8 Feb. 1909.

Demonstration: Some germinating seeds of the Mango, 12 July 1910.

A bacterial disease of the Mango. Read 15 Apl. 1915. (Pub. in Annals of Applied Biology, II. No. 1, May 1915, pp. 1–45, 14 plates.)

ENSOR, G. E.

Demonstration: The "X rays." 16 Oct. 1913.

FREI, Dr. W.

On Viscosity of Blood. Read 17 Jan. 1908.

On Surface Tension in Serum. Read 15 June 1908.

FULLER, CLAUDE.

An encounter between a Mierkat and Cobra. Read 28 Oct. 1915.

GONDER, Dr.

A note on Lamblia sanguinis. Read 25 Oct. 1910.

The Life-Cycle of Theileria parva. Read 25 Oct. 1910. (Pub. in Annals of Tvl. Mus. Vol. II. No. 4, p. 241.)

The Life-Cycle of Piroplasma parvum. Read 12 May 1912.

(Publ. in Trans. Roy. Soc. S. Afr. Vol. II. Pt. 1, p. 63.)

The Life History of Hæmoproteus columbiæ. Read 17 Feb. 1916.

GOUGH, Dr. L. H.

Demonstration: Some Stages in the Life History of Strongulus contortus *Rud.* 17 Jan. 1908.

Demonstration: The type specimens of Eremias schoenlandi and Rhinolophus swinnyi. 13 Apl. 1908.

On the S. African species of Agama. Read 15 June 1908.

Demonstration: A Transvaal specimen of Dibothriocephalus latus (*L.*) and of some extremely large Cysticerci resembling C. tenuicollis from the Rooi Rhebok (Cervicapra fulvorufula). 15 June 1908.

Demonstration: Some phases in the Development of Sclerostomum. 10 Aug. 1908.

On a Cœnurus from the Duiker (Cephalophus grimmi). 8 Feb. 1909.

Notes on Stilesia centripunctata (*Riv.*). Read 29 Mar. 1909.

GREEN, H. H.

The origin and decomposition of Humus and its influence upon Nitrogen Assimilation. Read 16 Apr. 1914.

(Pub. in "Centralblatt für Bakteriologie," Abt. II. Band 40, 1914, under the title "Ueber die Enstehung und die Zersetzung von Humus, sowie über dessen Einwirkung auf die Stickstoff-Assimilation.")

Soil Biology and Soil Fertility. Read 15 Oct. 1914.

Retardation and Acceleration of Egg-production in the Fowl brought on by the administration of Organ extracts. Read 23 May 1916.

GREY, C. E.

The History of East Coast Fever. Read 10 Aug. 1909.

(Pub. in Ann. Rep. S.A.A.A.S. 1908.)

The Progress of Veterinary Science in S. Africa. Read 29 Mar. 1909.

GUNNING, Dr. J. W. B.

Demonstration: A diseased skull of Papio porcarius. 17 Jan. 1908.

On the re-discovery of Burchell's Zebra. Read 23 May 1911.

HAAGNER, A. K.

The members of the Order Primates found in S. Africa. Read 17 June 1913.

A lantern lecture on S. African Birds and Mammals. 19 Sept. 1914.

Game and Bird protection in S. Africa. Read 16 Sept. 1915.

HARDENBERG, C. B.

Review of the present state of our knowledge of Termites. Read 7 Feb., 28 Feb., 23 May, and 19 Sept. 1911.

Demonstration: Three species of Moths (not Codling) which live in apples and other pomaceous fruit. 25 May 1911.

Exhibition: Ticks, Lice, and Fleas taken from a Zorilla striata killed at Munnik, N. Tvl. 19 Sept. 1911.

Demonstration: A small Moth injurious to Wheat. 16 Jan. 1912.

HARDENBERG, C. B. (*cont.*).

Demonstration: A new Bee of the genus Megachile. 16 Jan. 1912.

Demonstration: A number of Cocoons made by gregarious Caterpillars allied to Anaphe. 16 Jan. 1912.

The Yolk Nucleus and development of the Yolk in the Egg of Lecanium hemisphericum. Read 16 Jan. 1912.

Exhibitions: (1) The parasitic larva of some fly found beneath the epidermis of buck; (2) Honey, brood combs, and imagines of a small underground Bee; (3) a series of Termites from Natal. 21 May 1912.

Exhibitions: (1) An immature form of the larva of a Beetle found in a Termites' nest; (2) Some Scale-insect coverings in which some parasitic Lepidoptera had developed. 13 June 1912.

Life History and development of the Willow-tree caterpillar (Angelica tyrrhea). Read 25 July 1912.

Demonstration: A small Lepidopterous Parasite in the egg-cases of a small Beetle. 19 Nov. 1912.

The Aloe Gall. Read 28 May 1914.

A species of Microdon larva. Read 15 July 1915.

Notes on the Life History of Parasa latistriga *Walker*. Read 26 Aug. 1915.

HEWITT, J.

The Zoological Regions of S. Africa as deduced from the composition of its Lacertilia. Read 12 May 1910.

The Second Bronchial Arch in various S. African Lizards. Read 12 July 1910.

A brief review of the relationship and probable origin of the Amphibious Fauna of S. Africa and Madagascar. Read 4 Apl. 1911.

HOWARD, C. W.

A new species of Tick found in the Transvaal. Read 17 Jan. 1908.

(Pub. in Ann. Tvl. Mus. Vol. I. No. 2, p. 170.)

A note on the copulation of Ticks. Read 29 Mar. 1909.

(Pub. in Ann. Tvl. Mus. Vol. I. No. 4, p. 225.)

A note on the occurrence of Tsetse Fly in the Province of Mozambique. Read 29 Mar. 1909.

(Pub. in Bulletin of Entom. Res. II. Pt. 1.)

A new species of Hæmaphysalis from East Africa. Read 29 Mar. 1909.
(Pub. in Ann. Tvl. Mus. Vol. I. No. 4, p. 219.)

HOWARD, Mrs. A. B.
On the light-organs of Fire-flies. Read 12 July 1910.
(Pub. in Ann. Tvl. Mus. Vol. III. No. 1, p. 58.)

JANSE, A. J. T.
Demonstration: New Transvaal Microlepidoptera. 13 Apl. 1908.
On Petovia marginata *Walk.* and P. dichroaria *H.-S.* Read 15 June 1908.
The Jumping Bean. Read 13 June 1912.
Demonstration: The Life History of Deudorix licinia *Mab.* and Eublemma costimaculata *Saalm.* 16 July 1914.
A contribution to our knowledge of the Lymantriidæ. Read 20 Aug. 1914.
The value of Wing Venation in the phylogenetic study of Lepidoptera. Read 18 Feb. 1915.
Observations on a description of some new Psychidæ and Cossidæ. Read 23 Mar. 1916.

KAY, Dr.
Demonstration: Bilharzia. 18 Mar. 1913.

KEHOE, D.
The Poison effects of Cotyledon. Read 19 Nov. 1912.
The Red Blood Corpuscle. Read 23 Sept. 1913.
The Cultivation of Tissue in vitro. Read 19 Feb. 1914.

LEENDERTZ, Miss.
On Myrica æthiopica, the Wax-berry. Read 13 Apl. 1908.
On Sarcocaulon, the Candle-bush. Read 13 Apl. 1908.

METHUEN, Hon. P. A.
An account of a first visit to Madagascar with special reference to the giant subfossil Lemurids. Read 16 Jan. 1912.
Demonstration: A fine series of Lizards, Chameleons, etc. collected in Madagascar. 21 May 1912.
Two new Frogs and two new Lizards. Read 13 June 1912.
Some tropical Fish found near Pretoria. Read 20 May 1913.

MOORE, W.

Address on the San José Scale. 11 July 1911.

Demonstration: Two larvæ of Gynanisa maia *Klug*, one from Wattle and one from Apple. 19 Sept. 1911.

PEARSON, Prof.

Botanical rambles in German S.W. Africa. Read 17 Apl. 1913.

POLE EVANS, I. B.

Exhibition: Some parasitic Fungi. 13 Apl. 1908.

The results of some infection experiments with certain so-called Rust-proof Wheats. Read 10 Aug. 1908.

(Pub. in Ann. Rep. Trans. Dep. Agr. 1907–8, p. 131.)

Notes on the susceptibility of some Indian Wheats to Rust in the Transvaal. Read 10 Aug. 1908.

(Pub. in Ann. Rep. Trans. Dept. Agr. 1907–8, p. 130.)

Exhibition: Specimens of a large Puffball of the genus Collisaceum. 19 Sept. 1911.

A new Rust found on Wild Asparagus. Read 17 Oct. 1911,

The Fungi of Termites' nests. Read 4 Apl. 1911.

A parasitic Fungus on some Bagworms from Natal. Read 21 May 1912.

(Pub. in Annales Mycologici, 1912, pp. 281–4.)

Fungi collected by the Maputa River Expedition. Read 15 Oct. 1914.

Six new species of Aloe. Read 19 Nov. 1914.

ROBERTS, A.

Demonstration: Showing the variation of colour of Birds as caused by Climatic Conditions in different localities in S. Africa. 11 July 1911.

The relationship of flight to the first primary in the wing of birds. Read Nov. 1911.

(Pub. in Jl. S.A. Orn. Un. Vol. IX. p. 106, 1913.)

The Rodent genus Dendromus. Read 25 July 1912.

(Pub. (in part) in Ann. Tvl. Mus. Vol. IV. p. 83, 1913.)

Demonstration: The difficulty encountered in placing all the species of the genus Cisticola under that one generic head. 16 July 1914.

A new Siskin. Read 14 Dec. 1915.

(Pub. in Ann. Tvl. Mus. Vol. V. p. 257, 1917.)

Parasitic habits amongst Finches. Read 27 Jan. 1916.

(Pub. in Ann. Tvl. Mus. Vol. V. p. 259, 1917.)

ROBINSON, E. M.

Sera Diagnosis. Read 17 June 1915.

THEILER, Sir ARNOLD.

Further transmission experiments with East Coast Fever. Read 17 Jan. 1908.

Statistics regarding Inoculation against Equine Piroplasmosis. Read 13 Apl. 1908.

On Piroplasma bovis and P. bigeminum. Read 15 June 1908.

The influence of cold on Ticks and Piroplasma parvum. Read 10 Aug. 1908.

The presence of Trypanosoma dimorphum *Lav.* in South Africa. Read 8 Feb. 1909.

Transmission experiments with Piroplasmosis and Spirillosis with Ticks. Read 29 Mar. 1909.

Enaplasma marginale. Read 12 May 1910.

On Crotalaria burkeana, the cause of "Stiff-sickness" in Cattle. Read 12 July 1910.

Demonstration: A Tick, Ornithodorus megnini, thus far not recorded from S. Africa. 11 July 1911.

THOMSEN, F. T.

Demonstration: A Cocoon of a gregarious native Silk-spinner of the genus Anaphe. 23 May 1911.

VAN DER BIJL, Dr. P. A.

A Study of a Mottled Disease of the Black Wattle. Read 19 Mar. 1914.

(Pub. as Science Bulletin No. 4, Dept. Agr. Union of S.A. 1914.)

Wilt or Crown rot disease of Carnations caused by Fusarium sp. Read 18 Mar. 1915.

(Pub. Annals of Applied Biology, Vol. II. No. 4, p. 267, 1916.)

Polysaceum crassipes *DC.*, a common Fungus in Eucalyptus at Pretoria. Read 18 Nov. 1915.

(In press. Trans. S. A. Roy. Soc. Vol. IV. Part 3.)

VAN HOEPEN, Dr. E. C. N.

A newly described Fossil from Senekal, O.F.S. Read 19 Sept. 1911.

(Pub. in Ann. Tvl. Mus. Vol. III. No. 2, p. 102.)

Structural peculiarities of Myriodon. Read 15 July 1915.

WAGER, Prof. H. A.

Preliminary note on a probably new species of Turbellaria from Natal. Read 25 Oct. 1910.

A new vegetative means of reproduction in a Moss. Read 5 Dec. 1910.

Respiration in Plants and Animals. Read 4 Apl. 1911.

Cell energy. Read Nov. 1911.

The drought-resisting capacity of Maize. Read 25 July 1912.

Pollination in Thuja. Read 19 Nov. 1912.

A Nematode Worm in the Tomato. Read 20 May 1913.

WALKER, J.

Piroplasma parvum and P. mutans. Communicated 8 Feb. 1909.

THE

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NATURAL HISTORY.

Vol. I. MAY, 1918. No. 1.

The Captain Scott Memorial Medal.

(Plate I.)

When it became known that Captain Scott and several members of his Expedition had perished in their effort to reach the South Pole, funds were collected throughout the Empire towards the relief of the families dependent upon the lost explorers, and towards the erection of a memorial to the leader of the party.

Under the auspices of the Transvaal Biological Society a little over £100 was contributed by residents of Pretoria. But when the chairman of the General Fund,—the Lord Mayor of London,—was advised of this money being on hand, he informed the Society that the funds already collected were quite sufficient and he suggested that the proposed contribution should be utilized for the erection of some local memorial to the explorer.

Having obtained the permission of the various contributors and after mature consideration, the Council of the Society decided to devote the interest upon the capital fund to the striking of two annual Memorial Medals—a Junior and a

Senior—to be awarded to Transvaal writers of the best essays on Biological or Geographical topics.

The first competition was arranged for 1916. The Senior Medal was offered for the best essay on "The Uses and Objects of Polar Research," and the Junior Medal for the best essay on "The Maintenance of the Balance of Life between the different Classes of the Ferns of the Transvaal." Although the nature and terms of the competition were widely circulated, they met with no response, no essay was submitted and no medal awarded.

In October 1916 the subject was debated by the Society as a whole, and it was decided to place the fund in the hands of Custodians to carry out the object in view to the best advantage.

The Custodians appointed were Messrs. A. J. T. Janse (Convenor), H. H. Green, A. K. Haagner, D. Kehoe, and I. B. Pole Evans.

The following month the Custodians met and decided to recommend to the Society the abolition of the competitions and the adoption of the following alternative :—

To award the Junior Medal annually to the South African Student receiving the highest marks in either Botanical, Zoological or Geological Science, as selected for the year by the Custodians, in his final B.A. degree.

To grant the Senior Medal annually to that member of the South African Biological Society recommended by the Council of the South African Biological Society for merit in Biological Science and special services rendered to the Society.

The alternative recommendation was submitted to and accepted by the Transvaal Biological Society, and in this way the memory, the achievements and fate of Captain Scott and his party will be perpetuated in South Africa.

(A. J. T. J.)

The Captain Scott Memorial Medal Design.

How to Collect, Preserve, and Study Lepidopterous Insects in South Africa. By A. J. T. JANSE, F.E.S. (Lond.).

(Plate II.)

PART I.

THE Lepidoptera, or butterflies and moths as they are ordinarily called in daily life, have always formed attractive objects to the students of Nature, and by far the greatest number of entomologists are lepidopterists or have been so during their earlier moments of insect study. The reason for this is to be sought for in the extreme beauty of coloration and markings found among the members of this order, and perhaps also in the comparative ease of preparing and preserving them. In fact some collectors think it so easy, that they call any accumulation of moths or butterflies stuck through with pins and placed in a glass-topped box "a collection," and when instead of the lady's toilet variety entomological pins have been used, this brings the "collection" at once to a scientific standard.

It is not my wish to discourage such collectors; on the contrary, I would have them go on with their collecting as much as their free time will allow. But my maxim has always been: when you do a thing, do it in the best possible way you can, even if it means more trouble and time. This especially holds when we kill such beautiful creatures, even though they may sometimes be harmful; as killing in my opinion is only permissible when it is done with some good or useful object. To make a collection only to keep the specimens for one or two years or until they are thrown away in disgust in bleached and insect-eaten condition does not, I think, justify the killing of the insects involved.

Yet when collecting is done in a proper manner, the results can be preserved and studied for more than a hundred years and will remain a source of pleasure and intellectual interest to the possessor and student. If properly done, insect collecting is more than a hobby, it is a study, and the collection will be one of the building stones helping to erect the beautiful palace of Science.

My present aim is to instruct my readers in the scientific methods of collecting and in the preserving of a fine group of insects. I hope to enable some collectors to improve their collections, and I hope that those who have an inclination towards the study of butterflies and moths, but think its methods too intricate, will find them sufficiently simple to adopt at once the methods advocated. Naturally I shall be very pleased to give any further information required, and also to identify Lepidoptera for any readers who experience difficulty in their study of this group.

Apparatus required for Collecting.

The Net.—For collecting in daytime, the net is perhaps the most important instrument required, and it often depends largely on how the net is made and how it is used whether the collector will bring much home or not. Nets may be bought from dealers, but with a little expense and trouble, a good net may be made by any collector. To do this, make a ring of wire as shown in fig. 1. This should be about twenty inches in diameter, and galvanized iron wire about one quarter of an inch thick should be used. When made, the ring should be fixed by its straight ends into a hole that has been drilled into one end of a light but strong stick some thirty-six inches long. By using a thinner wire of steel a lighter net is secured. Some collectors prefer a stick much longer than three feet; but personal experience has taught me not only that a longer stick makes precision of movement less certain, but also that when collecting in between trees, a net with a long handle is most difficult to use. The next step is to sew on to the mounted ring a strip of cloth, about two inches wide and of the same colour selected for the net. The net itself should be a cylindrical bag with a rounded bottom and needs to be sufficiently long so as to fold over the ring at least twice. It should be of not too coarse a gauze; mosquito netting serves very well as long as it is dyed a light green colour. It is to be remembered that a white net forms a very conspicuous object against the usually green background of the collecting area and will scare most insects before the collector has an opportunity of reaching them with it. The net should not, however, be too dark in colour, as it is then difficult to see the captured insect in it. The same may be said of the collector's dress, a greenish colour will be found most useful. For very small moths, and even for those of medium size, a smaller net, about 10 inches across, made of green chiffon and fixed to a handle of a little over two feet, is to be preferred. With such a small net even the most delicately scaled moth of the smallest size can be caught and, what is more, transferred to the killing-bottle without any damage, whereas in the bigger net it would be hopelessly lost.

The Killing-Bottle.—The next important item is the killing-bottle; and, as few know how to prepare a "good" one, I will tell how to go about it. As a bottle, a "Mason" fruit jar with a three-inch mouth is about the best, provided it is furnished with a large and close-fitting cork in place of the screw-cap. The latter is far too cumbersome to work with. Having made your choice of a bottle and cleaned it thoroughly, place three or four lumps of Potassium or Sodium Cyanide in the bottom, fill in the spaces with dry sawdust until the poison is covered, and then place on top of this a neatly fitting piece of thick blotting-paper. This accomplished, pour over the blotting-paper some freshly prepared plaster of Paris paste to form a layer one quarter of an inch in thickness, taking every care that the plaster flows evenly and comes in contact with the sides of the bottle all round. Leave the bottle open for about six hours so that the plaster may dry. If, after this period, it is found to be too wet—which may be the case if the plaster was made too thin—use in abundance small pieces of blotting-paper to absorb the excess of moisture. Subsequently burn the scraps of paper so used as they are very poisonous. Unfortunately, whilst cyanide is the only poison that is suitable in our climate for killing-bottles, it is one of the most deadly to animal life generally. With proper care, however, there is no danger to an intelligent person neither in the preparation nor the use of a killing-bottle; but children should never be allowed to prepare or possess one.

When prepared the bottle should be just damp enough to cause the cyanide to liberate its poisonous gas, without being too damp to affect the colour of the specimens, as *dampness has a very bad effect on the colour of most Lepidoptera* and many other insects.

The Killing-Box.—A killing-box will also be found very useful in the field and can be prepared as shown in fig. 3.

Pins.—There are different kinds and qualities of entomological pins and the best only should be used. The saving effected by using poor pins is very little, and it is a pity to ruin a good specimen with a pin that corrodes rapidly. The best pin is certainly the "Genuine Klaeger" stiff steel black pin. This seldom rusts and is better than the white pin on account of its stiffness and thinness. If, however, a white pin is preferred, the "Carlsbad" pin is the best of its kind. The short pins commonly used in England are not recommended; they are mostly too short for collections in this climate. In any collection pins of an equal length should be used so that small and large specimens may be all on the same level. This not only gives uniformity and so improves the appearance of the collection, but it also provides for a close inspection of all the insects at one and the same time. The sizes 00 to 4 will be found the most useful. For very small moths, however, even the thinnest pin is too thick and "Minutien" pins must be used, as a thick pin often ruins a small specimen and certainly does not improve its appearance.

Forceps—A pair of forceps is absolutely essential in handling entomological pins, and most especially so when such bear insects on them. Forceps for this purpose should be curved and broad, and ribbed on the inner side so as to obtain a good grip on the pin. A pair of very finely pointed forceps, with the weakest spring possible, is also necessary for picking up specimens, a thing which should never be done with the fingers. I always make my own, as I have never yet been able to buy one in which the spring was light enough. I make use of steel springs which are used in place of whalebone in corsets. The following is the process of manufacture: having scraped off the paper and rubbed the steel quite clean with sand-paper, a piece about six inches long is heated at the middle in the flame of a spirit-lamp and then bent into the form shown in fig. 5. This done, the inner surfaces at "a" of figure are once more rubbed clean with sand-paper and a little fluxite put upon them, then a small flat piece of solder is inserted. By holding the two halves firmly together with the strong pinning forceps and heating the parts again in the flame, they solder well together. All that remains to be done is to grind the free ends until they are sharply pointed, and then a pair of forceps is complete with which the smallest moth can be lifted without injuring it.

Sundries.—A magnifying glass is indispensable and I think the Coddington folding lens will do for most work. Paper bags of various sizes, made as indicated in fig. 6, will be required for placing the butterflies in after they have been killed in order to bring them safely home. Such envelopes are also often used for sending moths and butterflies by post; but my experience is that only butterflies and moths that fold their wings upright when they die should be so packed; most moths will get their wings rubbed badly when packed in this way. Such moths and very small specimens are better pinned after having been in the killing-bottle for about ten minutes, the pinned specimens being then fixed in the cork of the killing-box. A collecting-bag, made of waterproof canvas, will be found very useful for carrying all these things in the field.

Collecting in Daytime.

Day captures will be mainly restricted to butterflies, although it is true that several moths can only then be obtained. Grassy places with bushes here and there will be found on the whole the most satisfactory; though glades are also good hunting grounds at the right season, when the flowers are within reach of the collector. However, close observation will soon teach the novice which places are the most promising, and he will, in course of time, also learn that many likely-looking places are sometimes painfully disappointing. My experience is that thickly wooded places are generally unproductive; this, I think, is not because they are not rich in lepidopterous life, but because it is difficult to see the insects and get them when one does.

The net must be used with a quick sweep and in such a way that the insect is caught right at the bottom of the net. Then with a quick turn of the handle this part is folded well over the ring. Care is necessary not to confine the butterfly in too small a space, as unless the wings are folded it will flutter and spoil itself to some extent. Large butterflies may, whilst in the net, be given a sharp pinch at the thorax to paralyse the wing muscles; this does not kill as some seem to think. Specimens must be transferred at once to the killing-bottle by introducing the open bottle into the net and allowing the insect to fly or drop into it. This done, double the net over the mouth of the bottle, put the cork loosely on top of it; this enables one to withdraw the net without risking the escape of the insect. Moths caught in the net, and also small butterflies, should be transferred into the bottle in the same way, but *without pinching*, as such treatment would, in most instances, spoil the insect.

Moths as a rule hide in the daytime, and it is therefore as well to carry a long stick in one hand with which to stir up the leaves and branches, having the net ever ready for action when something flies up. This method requires very quick action with the net, and for it the small net with short handle will prove the most effective, as there is less risk in catching branches or, worse still thorns, with the net just at the moment when something good turns up. On the whole the moth-hunter will not get a big collection in the daytime, but he will often be rewarded by securing interesting specimens which might not have been obtained otherwise. Moreover, caterpillar hunting might well be combined with day collecting, a branch thereof which I consider so important that I hope to give a special chapter on it later.

The great difficulty in day collecting is not only how to get the desired specimens, but also how to bring them home in *perfect condition.* This is especially the case with moths. Even if two bottles are used at the time, one for placing the insect in till it is stupefied and the other for final killing, it will be found that the movements of the collector during collecting and walking have been sufficient to spoil at least fifty per cent. of the contents; and the brilliant fresh specimens of half an hour ago are often changed into shadows of what they were. The only way to prevent this, is to pin, whilst in the field, every moth and all butterflies that do not close up their wings; doing this after they have been in the bottle for about five minutes, and then placing the pinned specimens in the killing-box. Large and small captures should be arranged in separate groups, as sometimes the big specimens revive a little and may then spoil the smaller.

Pinning moths and butterflies in the wrong way is often a weak point with even experienced collectors, yet the good setting of the insect depends largely on the proper pinning. The pin should go *perpendicularly* through the *centre* of the thorax and not as is illustrated in figs. 7 and 8. At home use a piece of sunflower pith to steady the insect on whilst pinning. As long as care is taken that no tufts are rubbed off, the small forceps may be used on the abdomen to keep the insect in the proper position. It should be remembered that where tufts are present they are often necessary to the identification of the species. In the field a pith helmet will be found most useful as an adjunct. In the inside one can carry the store of pins; when placed on the knees upside down, it gives a good surface for pinning insects, whilst the specimen can at the same time be sheltered a little from the wind. In fact, I find that pinning in the field is almost as easy as it is at home; the only disadvantage is that it takes a little time, but this means nothing to one who prefers quality to quantity.

The other butterflies may be packed in the paper envelopes as already indicated, and when they are placed in a card-board box they will carry quite safely even over a long distance.

Collecting at Dusk.

At dusk quite a number of moths fly about (Sphingids, Phytometrids, etc.), and several of these can be captured only at that time. It is a good plan to grow near the home some flowers with the view of attracting such dusk-flyers. Petunias, honeysuckle, etc., are very good for the purpose. The catching is done with the net, and when it gets rather dark it is a great help to have somebody hold a small lantern (bull's-eye) so as to throw some light on to the flowers, and on the net when transferring the insect. At this time of the day some small moth specialities may be obtained by sweeping the big net gently through the grass; Pterophorids and Tineids may be caught in this manner.

Rearing.

This is such an extensive and such an important means of obtaining specimens and, what is more, information about the species, that I will leave the subject for some future occasion, when I will devote a special article to it.

Collecting at Night.

There are two principal methods of night collecting, "sugaring" and attracting moths by light. The first method is very uncertain and less successful in South Africa than in Europe. I must confess that I cannot account for this, but I have come to that conclusion after making many attempts. For those who wish to give it a trial I will describe the method briefly. The following is a good mixture for "sugaring." Take 1 lb. of brown sugar, $\frac{1}{4}$ lb. treacle, and $\frac{1}{4}$ bottle of beer; mix and heat to boiling point, stirring all the time. Put this in a corked bottle until wanted for use. Before using, add a wine-glass of rum and stir well. With a stiff brush, paint the mixture on tree-trunks, rocks, etc., within easy reach, say breast-high. This painting might be done at dusk, and every place should be well marked so as to find it easily in the dark. The best places for "sugaring" are glades, edges of bushes, etc., but it is as well to select spots with little undergrowth. Many a moth would be lost in the lower shrubs, and also there is more difficulty in spotting snakes. These undesirable visitors are often drawn to the "sugar" in the following way. The insects which are attracted by the "sugar" frequently drop down and toads come to feed upon them, and sometimes three or four may be seen at the base of the "sugared" spot. These in their turn become a source of attraction to the snakes. It is therefore best to be careful and remove as much of the vegetation underneath the selected spot as possible.

Some nights are better than others for this method of collecting. Windy and moonlight nights are always unproductive. A light rain on the other hand often makes moths come out in abundance. When it is dark, the collector visits the "sugared" spots one after another, armed with a "bull's-eye" lantern. It will be found most pleasant to take a friend along, who can also make himself useful in carrying the lamp and holding, perhaps, a killing-bottle.

When an insect is seen on the edge of the "sugared" spot a small killing-bottle is simply placed over it without touching the "sugar," then a stiff card is inserted between the mouth of the bottle and the rock or tree-trunk; and, when the moth is sufficiently stupefied, it is dropped into the larger killing-bottle. In this way a number of moths may be caught with ease, if they only come to the "sugar," which is, as I said, much too rarely the case in this country to warrant spending many nights collecting in this way. I must add, however, that the moths so caught are usually different from those caught at light.

Lamplight catching is, on the other hand, perhaps more successful in South Africa than I found it to be in Europe, and at least three-quarters of my collection has been obtained in this manner. The principal point is to have a good light. This means the *right kind* of light as well as one of *sufficient strength.* It is true that even candle-light and camp-fires attract moths, but both are obviously insufficient for collecting on a scale that rewards the trouble of waiting for what comes. The next thing is the ordinary paraffin lamp of about

30-50 candle-power. For many years I have collected with such a light and with fair results, but it is easily beaten, even candle-power for candle-power, by the incandescent burner. These are made of various types, but I find the paraffin incandescent light the most effective, economical, and easiest to handle of the lot (fig. 9). The lamp should, however, always be of a type that has the mantles enclosed, and this is not often the case in such lamps as are sold for use in the house. (Information about the best type of lamp can always be had from me.) Acetylene light I find less attractive to moths than any other light and, though the light may be brilliant, it never comes up to expectation in attracting moths. Electric light is, of course, out of the question, as we can seldom get this in a locality suitable for collecting. Go with your light where there is a good deal of vegetation, yet where the light can be seen from a good distance and where there is sufficient shelter from wind. Wind is also fatal to this kind of collecting, whereas rain often assists more than one would expect. The open spaces in woods, the side of a wooded road, and the slope of a hill are most promising places, though often a great variety of smaller things may be had from grass-covered land.

Place your light on a table that is covered with a white cloth, as on this the moths will often settle for a moment; it also reflects the light, and so makes the most of the candle-power produced. The more candle-power the more success, I think.

Have two bottles with you, covered with a glass-bottomed box as in the sketch (fig. 2). Have also at least two additional boxes in reserve. When a moth settles for a moment on the cloth, quickly place the box over it, insert a stiff card (an old post-card will do) between the table and the box and place box and card bodily onto the open killing-bottle. By withdrawing the card, the insect will drop after a little while into the bottle without being touched and, if the bottle is poisonous enough, it will be killed without even a scale coming off. If such boxes cannot be had, a dry tumbler may be used, as long as it fits the bottle. Suitable glass-bottomed boxes of the correct size may be obtained from Watkins & Doncaster, 36 Strand, London, at a small cost. Boxes three inches in diameter are required for the Mason fruit jars recommended as killing-bottles.

Do not place too many moths at a time in the killing-bottle, as the bigger moths especially soon damage the others. I prefer to change them over to the other bottle every time three or four are in it, as soon as they do not move any more. It is during their movement that they do most damage. It is also a good plan to keep separate bottles for the smaller things. Keep the moths in the bottles for about six hours, they are sure to be dead by that time and they will not have stiffened.

Great care should be taken in carrying the moths home when still in the bottles, as the movement will rub the wings a good deal. If you cannot pin them on the spot and have to go a good distance with them, it is a good plan to take a killing-box and place a thin layer of cotton wool in it. Place the moths on this so that they do not come in contact with each other. In this way I have often transported them over a distance of ten miles in a motor car without any injury. The time of the night is not immaterial, though no fixed rules can be laid down as to what hours are the best. It has often happened to me that from night-fall on till eleven o'clock I have had only moderate success, and then, just as I decided to give up, fresh specimens came and kept me busy till dawn. One thing is certain, quite different species are captured, as a rule, during the small hours from what are obtained before midnight. Sometimes hardly anything appears for three or four hours and then comes a rush sufficient to keep one going even if possessed of four hands. So never despair, but keep awake as long as you can, when the weather conditions are favourable.

Preparing the Insects at Home.

In addition to the apparatus already described, a few more additional requirements are necessary. Several of these can be bought in this country or, at any rate, in Europe;

but, as it is often more satisfactory to make them, I will describe a few and how to prepare them.

Relaxing-box.—This is a tight tin box with a well-fitted lid. Having selected a box, obtain some coarse sand, wash this well, and when dry bake it a few hours in the oven of a kitchen stove. Spread a layer on the bottom of the box and then moisten it well with *boiled* water, to which a *little* carbolic acid has been added. This will prevent mould to a large extent. Cover the sand with a sheet of thick blotting-paper and place on top of this a thin sheet of cotton wool.

Some collectors use a glass bell-jar over a plateful of moist sand; but I do not advise this, as light and moisture combined ruin the colours more effectively and far more rapidly than either of the two separately. Further, do not keep moths or butterflies in the relaxing-box longer than is really necessary. The fresher the specimens are, the shorter this period can be: in fact, fresh specimens hardly require relaxing at all.

Setting-boards.—A large variety of setting-boards are advised by different entomologists and some very peculiar kinds are advocated. Sketches of some of them (figs. 10, 11, 12, 13, 17) will, I think, be sufficient to show at once that they are wrongly designed both for ease in setting and for giving a good pose to the insects both for study and general appearance.

As setting-boards sold by dealers are as a rule unsatisfactory (I have not seen such a one that I consider up to the mark), it is as well to have them made locally, or better still to make them oneself. Good *soft* wood is most important. The best in my experience is soft American poplar; but when this cannot be obtained, *clear pine* is the next best. Select soft wood without any knots in it and more than $\frac{7}{8}$ inch thick; *i.e.* one nominal inch. Cut from this long strips, a few 2 in. wide, some $1\frac{1}{2}$ in. wide, and quite a number of 1 in. wide. Plane these on the edges only; *one* of the flat sides is planed when the board is constructed. Next cut the strips neatly into 8 in. lengths, as this is to be the length of the setting-boards. Longer boards are rather cumbersome and render setting difficult, whilst shorter ones entail the making of many more. One edge may be planed so as to slant a little as is shown in figs. 13, 14, 15, etc. Next take some half inch nominal wood, and cut it in strips 5 in., $3\frac{1}{2}$ in., $2\frac{1}{4}$ in., wide. Plane this neatly on both the flat sides and then cut them into strips of 8 in. long. When all the pieces are prepared glue a $\frac{3}{4}$ in. thick strip on to an $\frac{1}{2}$ in. strip in such a way that the slanting edge is as in fig. 19. While the glue is still hot nail these together with a one-inch nail. Four nails will do for the whole length. Do the same with half the remaining quantity of strips, taking care that you use only one of each pair and that you fix the wide strips on the broad $\frac{1}{2}$ in. wood. To complete the setting-boards take some peat, such as is used for lining the drawers of insect cabinets or, failing this, use sunflower pith; cut the pith with a sharp knife into strips of various thickness, from $\frac{1}{5}$ in. to $\frac{3}{4}$ in. This done, put a *little* glue on the top of the base-board, fix your strip of peat or pith in position, as shown in illustration, and, before the glue gets too cold, press the other thick strip of wood against it compressing the peat somewhat. Now nail on the wood as with the first strip. By compressing the peat more or less the width of the slit can be regulated. When all boards are finished plane the sides of the board and with a very *sharp plane* take away just enough of the top to make a *perfectly flat* surface. A piece of *fine* sand-paper will finish the board and it should last at least fifteen years. The following quantity of boards is recommended:—

Number required.	Measurement *a*.	Measurement *b*.
2	2 in.	$\frac{3}{4}$ in.
2	2 in.	$\frac{5}{8}$ in.
1	$1\frac{1}{2}$ in.	$\frac{3}{4}$ in.
1	$1\frac{1}{2}$ in.	$\frac{5}{8}$ in.
1	$1\frac{1}{2}$ in.	$\frac{1}{2}$ in.
2	$1\frac{1}{2}$ in.	$\frac{3}{8}$ in.
2	$1\frac{1}{2}$ in.	$\frac{1}{4}$ in.
2	1 in.	$\frac{4}{10}$ in.
3	1 in.	$\frac{3}{10}$ in.
3	1 in.	$\frac{2}{10}$ in.
4	1 in.	$\frac{1}{10}$ in.
Boards for minutien pins:		
12	$\frac{5}{8}$ in.	from 3 mm.–1 mm.

The boards used for very small insects, such as Micro-lepidoptera, are made from $\frac{1}{2}$ in. wood throughout and pith is always used instead of peat. The slits must be carefully regulated and the upper surfaces should be very carefully planed and sand-papered. If such setting-boards are to be taken abroad with insects on them it is a good plan to have grooves in the sides, which fit into T-pieces (as shown in fig. 17) of the shelves in the cupboard. The special cupboard should have plenty of ventilation, it should not be exposed to light and must be kept free from ants. In it set specimens carry very well.

Tracing cloth.—Tracing cloth, not tracing *paper*, cut into strips of from 2 mm. to 20 mm. in width and about 9 in. long is a further requirement. The narrower strips are used only twice ; but the wider strips, for covering the tips of the wings, may be used several dozen times.

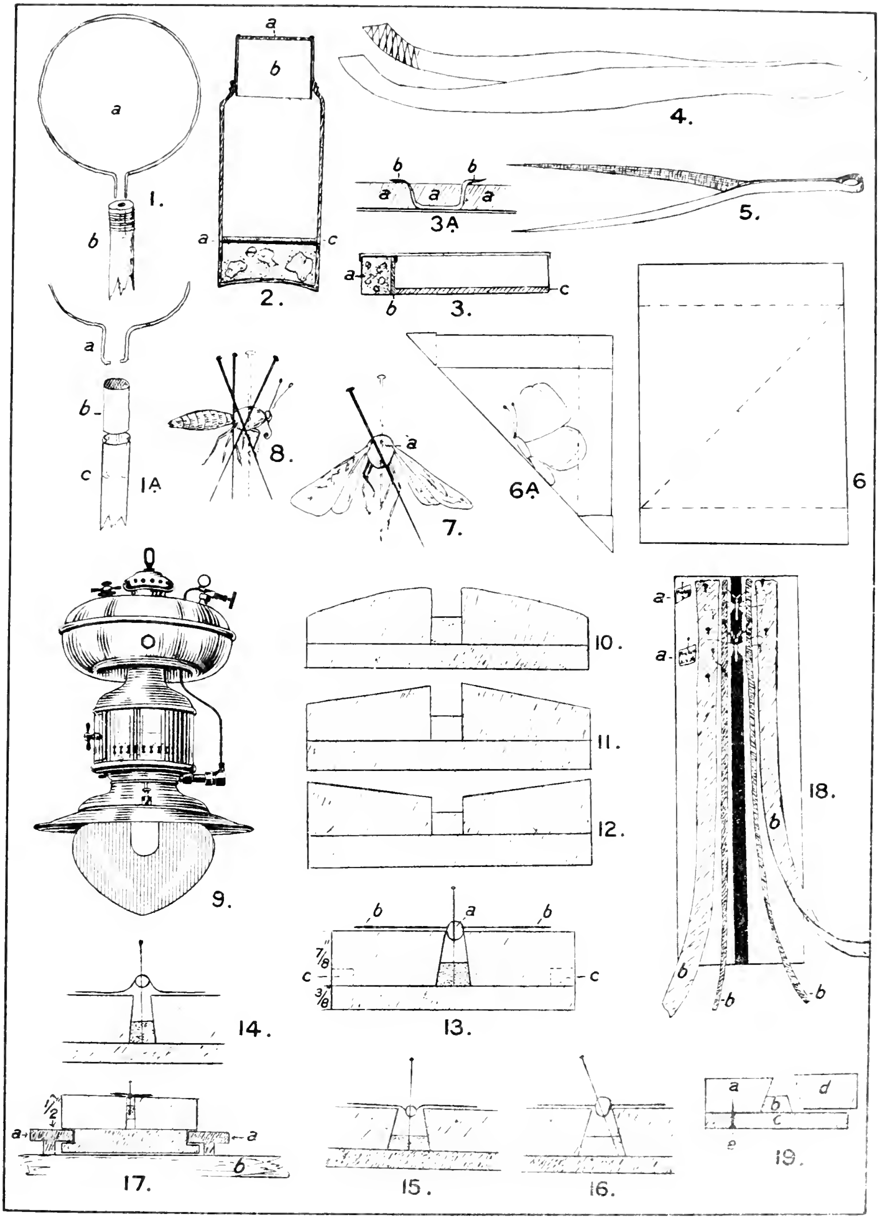
Setting needle and pins.—A very thin needle fixed into a thin wooden stick is required, together with a few hundred glass-beaded steel pins, about an inch long.

SETTING.

This requires great care if the best results are to be obtained. Do not be in a hurry and do not lose patience. Be sure that the insect is correctly pinned : if this is not the case, the setting must be a failure. Study figs. 7 and 8 carefully and see that the pin is in the position shown by the dotted lines.

EXPLANATION OF PLATE II.—THE SETTING OF LEPIDOPTERA.

1. (*a*) Wire ring ready for attachment to stick, (*b*) perforated top of stick. 1A. (*a*) Wire ring, (*b*) metal ring to clamp ends of wire to stick, (*c*) top of stick with slits cut to accommodate wire ends. 2. Killing-bottle with glass-topped box in position (*in section*), (*a*) glass of box, (*b*) box, (*c*) layer of plaster of Paris, (*d*) blotting-paper, (*e*) sawdust and cyanide. 3. Killing box (*in section*), (*a*) cyanide and sawdust, (*b*) plaster of Paris, (*c*) sheet of cork. 3A. Showing how cork is fixed to bottom of killing-box by strips of tin, (*a.a.a*) cork, (*b.b*) tin strip soldered to bottom of box. 4. Pinning forceps. 5. Lifting forceps. 6. Butterfly envelope (open), the dotted lines show the various folds. 6A. Butterfly envelope folded. 7. Illustrating faulty pinning, (*a*) thorax. (The



APPARATUS FOR COLLECTING LEPIDOPTERA

dotted line shows the correct pinning); end view. 8. Illustrating faulty pinning (the dotted line shows the correct pinning); side view. 9. Incandescent lamp, pattern used by author. 10, 11, 12. Three bad types of setting-boards. 13. Right type of setting-board with correct position of insect indicated, (*a*) thorax of insect, (*b.b*) wings, (*c.c*) grooves. 14, 15, 16. Illustrating faults in setting insects on boards. 14. Insect too high. 15. Insect too low. 16. Pin not perpendicular. 17. Grooved setting-board designed for using minutien pins and for placing on shelf of travelling cabinet, (*a.a*) T-pieces, (*b*) shelf. 18. Illustrating method of setting, (*a.a*) locality labels, (*b.b.b.b*) tracing cloth. 19. Showing construction of setting-board, (*a*) left piece glued and nailed on, (*b*) strip of pith, (*c*) base board, (*d*) piece to be fixed on, (*e*) nail.

On Birds collected and observed in the Districts of Okanjande and Outjo, S.W. African Protectorate. By C. G. Finch-Davies, M.B.O.U., Lt. 1st S.A.M.R.

As I have now been stationed in this country for the best part of a year, and have been out almost daily, having travelled some 1000 miles or more through various parts, I feel that I have obtained a fair knowledge of the bird-life of the above-mentioned districts. I venture to write the following notes in the hope that they may prove to be of some interest, more especially as, since Andersson's time, little has been written in the English language of the Birds of S.W. Africa. No doubt collections have been made by the Germans and several new forms described in German works by Reichenow and others. I also understand that the Transvaal Museum has received collections from Okahandje and Windhuk, both of which districts adjoin this. No doubt I shall be able from time to time to add a good many species to my list, but with the exception of some of the smaller forms and stragglers, I think I have collected most of the resident and migratory forms. Before starting a list of the species, I think it would be advisable to give a short description of the country in which my collecting has been done. Okanjande lies on longitude 17°, and between 20° and 21° South latitude. Outjo is about 60 miles to the west and a little farther north, but the country is very similar.

The climate is good, although during summer the heat is very trying, but there is usually a cool breeze, especially at night. The winter is delightful, the nights being then cold, with often a sharp frost. The approximate height above sea-level is 4000 feet. For the most part there is no surface water, all water being obtained from wells, with the exception of springs that occur here and there, notably from the sides of the Waterberg Range. During the rains, which usually occur about November, there are rain pools to be found in the veld, and some of the farms have dams which contain water. There are several rivers, but these are dry, except after heavy rains when they run for a short time. The country is for the most part level, with isolated kopjes and ridges rising here and there, notably in the Outjo district, where, in the vicinity of the village, the country is rather hilly. There are only two ranges of hills of any importance, a high range between Okanjande and Outjo, and the Waterberg Range almost due east of Okanjande. The country is what may be termed "bush veld," being covered with various kinds of thorn bush, very dense in parts, in others thinning out and giving place to open grassy flats. In parts "sand veld" occurs. To the north of Outjo, about 75 miles, lies the Great Etosha Pan, a vast open pan 70 miles long and 40 miles broad, quite dry in the dry season, and with a varying quantity of water during the rains. Apart from the bird-life, the country abounds in big game, principally kudu, gemsbuck, hartebeest and wildebeest, and in some parts, zebra, springbuck, eland, and a few roan antelope, also several of the smaller buck: duiker, steenbuck, klipspringer, and the Damaraland dik-dik (here called bluebuck). In the north-west elephant and giraffe are found; leopards are numerous, also various wild cats, jackals, wild dogs, etc. Lions are not uncommon in the vicinity of the Etosha Pan, and occasionally stray to other parts of the district.

I might mention that during the recent campaign I collected a few birds at Otavifontein, about 75 miles north of Okanjande, amongst which were two species of great interest, as being additions to the fauna of South Africa. The one was Hartlaub's francolin (Francolinus hartlaubi), of which I secured a male and female, and which has so far been recorded only from Angola. It is a small bird, with a striking difference in the sexes, both sexes being brown above, but the male is whitish, striped with dark brown below, the female having the under parts uniform pale rufous. I found them in pairs frequenting the grass and bush on the kopjes. The other species was the Bald-fronted Green Pigeon (Vinago calva nudirostris), which I found in the same locality. These specimens are now in the Transvaal Museum. I also met with the rare Rueppell's Korhaan (Otis rueppelli) in the neighbourhood of Usakos; they were found on the bare rocky ground to the south, and seem to resemble the Vaal Korhaan in habits, note and flight, and had the same beautiful pink sheen on the plumage. In the following list I have followed the nomenclature of the Transvaal Museum, "Check List of Gunning and Haagner."

List of Species.

1. Struthio australis—Southern Ostrich. Common throughout these districts, going about often in large flocks. Considering how wary these birds are, I was very surprised to find them remarkably tame, and they often allowed one to ride past within 100 yards, without much sign of alarm.

2. Anas erythrorhyncha—Red-billed Teal. I met with a small flock of these birds on a large dam near Outjo.

3. Sarkidiornis melanotus—Knob-billed Duck. One morning while on parade at Okanjande, a flock of six of these birds passed over, flying in a southerly direction; this was during the rains.

4. Chenalopex ægyptius—Egyptian Goose. A small flock frequented the same dam as the Red-billed Teal above mentioned. They were not wild, and I secured a fine specimen.

5. Cursorius temmincki—Lesser Courser. I encountered a few small flocks of this species, principally on the sand-veld to the south-west.

6. Rhinoptilus chalcopterus—Bronze-wing Courser. I have met only with this species on one or two occasions and I think it must be rather rare. Those I saw were amongst rather thick bush.

7. Charadrius tricollaris—Three-banded Plover. I observed a few of these little plovers frequenting the shores of dams when these contained water.

8. Stephanibyx coronatus—Crowned Lapwing. This species is not uncommon, being found in small flocks in the vicinity of farms, townships, etc., frequenting outspans, cattle kraals, and open cultivated ground.

9. Œdicnemus capensis—Cape Thick-knee. I have not *seen* many of this species, but have often heard its call at night round the camp.

10. Totanus littoreus—Greenshank. I saw a single specimen on a large rain-vlei near Waterberg.

11. Totanus glareola—Wood Sandpiper. Found in small numbers, by dams and rain-pools, in the veld.

12. Otis kori—Gom Paauw. Not uncommon ; I have found them all over the district right up to the border of the Etosha Pan. It would be interesting to get records of the weight of this species, as weights have been recorded up to 60 lbs. The largest I have personally seen weighed 35 lbs.

13. Otis ruficrista—Red-crested Korhaan. Fairly common throughout ; it appears to be somewhat crepuscular in habits, being rarely visible in the day, but towards sunset it is often to be seen.

Millais, in his beautiful book, " A Breath from the Veld," describes and gives sketches of the curious " love flight " of this korhaan, but I think he is wrong on one point. He gives drawings showing the bird " diving " with head and neck extended, whereas I have often watched them, and it has appeared to me that the head and neck are thrown backwards along the back ; at any rate the bird goes straight up into the air to a height of 30 or 40 feet, for all the world as if someone had thrown a dead bird up into the air. No head or neck can be seen, until the bird is descending, when the head is thrown forward and the bird drops to the ground in a normal manner.

14. Otis afroides—White-quilled Black Korhaan. Common everywhere throughout the district, wherever patches of open grass country occur. I have noticed a curious habit of this bird—viz., that of pursuing and mobbing jackals whenever these animals are discovered by them in the open. I have noticed that specimens shot in this country have a *white* ring surrounding the brown of the crown.

15. Anthropoides paradisea—Blue Crane. I saw a pair of these birds on the border of the Etosha Pan.

16. Actophilus africanus—African Jacana. I found a pair of these birds on a large rain-vlei near the Waterberg and secured a female.

17. Turnix lepurana — Kurrichane Button-Quail. Very common, especially in the Outjo district. I have never seen so many button-quails before in my life, as I did one day in June when driving through some long grass ; they were rising in twos and threes every few yards, for miles.

18. Pterocles gutturalis — Yellow-throated Sand-Grouse. I have met with this species only in the sand-veld to the south-west, when I located a few pairs along the sandy roads.

19. Pteroclurus namaquus — Namaqua Sandgrouse. I have never seen this species in the Okanjande district, but in the Outjo district it was very common, large numbers regularly visiting the water-holes to drink.

20. Abdimia abdimii — White-bellied Stork. In March, after we had had good rains and all the country was looking beautifully green, large flocks of these birds

appeared and stayed for a month, and were remarkably tame, walking about feeding within a few yards of one. A specimen I shot had the crop crammed with small green caterpillars, but nothing else.

21. Ciconia nigra—Black Stork. I saw a single specimen sitting on a dead tree near a dam, the only example I came across.

22. Scopus umbretta—Hammer-head. Seen in fair numbers wherever a dam, containing water, is to be found.

23. Vinago calva nudirostris—Bald-fronted Green Pigeon. This species is new to the fauna of S. Africa. I first secured a specimen at Otavifontein, and again met with it at Outjo, where it seemed to be scarce as I only saw two examples.

24. Columba phæonota—Rock Pigeon. Not common on the whole, as suitable localities are not numerous.

25. Turtur senegalensis—Laughing Dove. Fairly common throughout.

26. Turtur capicola damarensis—Damara Turtle Dove. Very common everywhere, especially in the vicinity of farms and villages, and resorting in thousands to the water-holes and wells to drink.

27. Œna capensis—Namaqua Dove. Common everywhere. I have noticed a great mortality amongst the young of this species. At Outjo I was continually picking up dead, fully fledged, young birds.

28. Numida papillosa—Damara Guinea-fowl. Fairly common throughout the district and often occurring in large flocks.

29. Pternistes swainsoni — Swainson's Francolin. Common, especially amongst the thorn bush along the dry water-courses: it is a poor sporting bird, running like a hare. Its low strident call is to be heard on all sides, especially in the morning and evening during the breeding season.

30. Francolinus adspersus — Red-billed Francolin. Common, and found in the same localities as the previous species, but it seems to be more confined to the vicinity of water-courses. It is an even worse skulker than the Pternistes.

31. Francolinus jugularis pallidior — Eriksson's Francolin. This species is not common, and apparently confined to the hills.

32. Otogyps auricularis—Black Vulture. I have seen only a single specimen of this vulture.

33. Lophogyps occipitalis—White-headed Vulture. This appears to be the common vulture of the country. I have usually seen them singly or in pairs, but large numbers may be found consorting together at a carcase. It is really marvellous how quickly all vultures observe a newly killed animal. I remember one day shooting a gemsbuck amongst fairly thick cover ; after opening it, I left the beast to be fetched by a cart, which arrived at the spot within an hour, and yet the vultures had already discovered and eaten practically all the meat. When I left it there was not a sign of a bird in the sky, and as the body was lying fairly well concealed by trees, I never thought it would be discovered.

34. Serpentarius secretarius—Secretary Bird. I think this bird must be rather rare in this country. I have seen only a single specimen.

35. Polyboroides typicus—Harrier Hawk. I have seen only a single adult and a young specimen of this species.

36. Melierax canorus—Chanting Goshawk. Fairly common. Usually to be seen perched on telegraph poles or on some dead tree near the road.

37. Astur polyzonoides — Little Banded Goshawk. This little hawk is not common. I have met with only two or three specimens, all immature birds.

38. Micronisus gabar—Gabar Goshawk.

Micronisus niger—Black Gabar Goshawk. I think that there can be no doubt that the Black Gabar is only a melanistic form of the common gabar, which has long been suspected by naturalists. Both forms are not uncommon about here, and I have secured several specimens of each. The following observations may be of some help in elucidating the matter. At Usakos I observed a pair of these birds, which frequented the vicinity of the camp. The male was a normal grey bird, and the female was of the black variety. At Okanjande I met with another pair and secured the female which was also black, the male being grey. It has been said that no young specimen of the black form has been found showing the change into the black plumage, but I am of the opinion that if it is a true melanism the bird would be black from the time it puts on feathers. A female specimen of the black form was shot by me here ; it was of a brownish-black colour, and had two feathers on the under parts which resembled the same feathers in a normal young bird. The final proof, however, will be in the finding of a nest and young.

39. Circaetus cinereus—Brown Harrier Eagle. I have seen several specimens of this eagle, generally perched on the summit of some lofty camel-thorn tree ; they are rather wild and I have failed to secure a specimen.

40. Spizaetus bellicosus—Martial Hawk Eagle. I have seen several specimens of this fine eagle from time to time, all young birds with the exception of one adult. I once saw one make a stoop like a falcon at a sandgrouse I put up, but the eagle failed to secure it.

41. Hieraetus pennatus—Booted Eagle. While camped one day near a big dam of water I saw a fine specimen, chasing the doves which came to drink ; it was not wild and I had a good view of it for a long time, it was in the dark-breasted young plumage.

42. Aquila rapax—Tawny Eagle. Not uncommon, frequently to be seen perched on some dead tree near the road. It often visits dead animals in company with the vultures, and I have recently seen the skin of a fine female which was caught in a trap set for jackals. Last July, when driving by motor from Outjo to Otjiwarongo, I passed a nest situated at the top of a thorn-tree, close to the road; the bird was on the nest and appeared to be sitting.

43. Helotarsus ecaudatus—Bateleur Eagle. Not uncommon, a day seldom passes without one or two being seen. In March last year I found a nest situated in the fork of a huge camel-thorn tree, which also contained several nests of the Buffalo Weaver. I believe the nest was tenanted, as I often saw the birds about, but it was quite inaccessible. I have seen several skins of adults and young that have been caught in traps set for jackals. I have not met with the white-backed form (leuconotus), but a male shot by me in April was somewhat pale in the colouring of the back.

44. Milvus ægyptius—Yellow-billed Kite. Not uncommon during the summer months, hanging about the vicinity of camps and villages in search of offal and chickens.

45. Elanus cæruleus—Black-shouldered Kite. Rather scarce. I have seen only one or two specimens.

46. Falco biarmicus—South African Lanner. Distinctly scarce. I have only on two or three occasions seen falcons, which I believe belonged to this species. I secured a fine adult in April.

47. Cerchneis rupicoloides—Large African Kestrel. Fairly common, especially about the Outjo district.

48. Cerchneis rupicola—S. African Kestrel. I have met with a few of these birds amongst the kopjes in the Outjo district.

49. Poliohierax semitorquatus—Pigmy Falcon. I have seen only a single specimen, a female, which was eating a locust while perched on the branch of a tree near the road.

50. Bubo lacteus—Giant Eagle Owl. I have seen only a single specimen of this fine owl.

51. Bubo maculosus—Spotted Eagle Owl. I have several times come across owls which I believe belonged to this species, and shot a specimen in April.

52. Glaucidium perlatum — Pearl-spotted Owlet. Very common at Okanjande, where it is always to be seen amongst the trees along the river; in the evening its curious whistling may be heard everywhere.

53. Strix flammea maculata—Cape Barn Owl. I have never secured a specimen, but its cry may be heard every night, and a pair seem to take a pleasure in disturbing my sleep by sitting on my verandah and making weird noises.

54. Poicephalus rüppelli—Brown Parrot. Not uncommon, and usually to be found in pairs frequenting the camel-thorn trees along the rivers. Although the male is described as having no blue on the rump, I have never shot one that had not some trace of blue—in a varying degree—some more, some less.

55. Agapornis roseicollis — Rosy-faced Love-bird. Very common in the Okanjande district, but during the wet season they are not often seen. In the dry season they come to water at the wells and tanks in thousands.

56. Chizærhis concolor—Grey Lourie. Common everywhere in suitable localities, preferring the big shady camel-thorn trees along the rivers. It is a most stupid, indolent bird and usually tame, for which reason I fail to understand why it should think it necessary to give the alarm to every bird and beast in the country. It is certainly not alarmed about itself, as it will calmly sit in a tree and let you pass underneath, while it shouts at you to "go away."

57. Clamator jacobinus—Black and White Cuckoo. I saw several of this species amongst the trees along the river in April, probably on their northward migration.

58. Clamator glandarius — Great-spotted Cuckoo. This species was common in March and April.

59. Cuculus clamosus—Black Cuckoo. This species was common in March and April, and its loud call could be heard everywhere.

60. Cuculus gularis.—S. African Cuckoo. I shot an adult of this species in April, and saw numbers of others which were either of this species, or canorus.

61. Tricholæma leucomelas—Pied Barbet. Fairly common everywhere. While spending a day at the Waterberg, I heard the note of a Tinker Barbet, but failed to secure a specimen.

62. Dendromus smithi—Smith's Woodpecker. Not common. I have seen only a few specimens at Okanjande.

63. Mesopicus namaquus — Bearded Woodpecker. Not uncommon amongst the camel-thorn trees along the rivers.

64. Dendropicus guineensis—Cardinal Woodpecker. Not very common. I have met with a few round Okanjande.

65. Coracias garrulus—European Roller. I saw a few of these rollers in March.

66. Coracias caudatus--Lilac-breasted Roller. Not uncommon on the whole, both at Okanjande and Outjo, but it appears to be somewhat migratory. Although fairly common at Okanjande in March and April, on my return to that place in September I did not see a single specimen. Usually this species is very wild, but when two or three brigades were camped at Otavifontein during the recent campaign, these birds were often to be seen perched on trees in the middle of the camps, quite fearless, and hunting their prey in the midst of horses and men.

67. Coracias mosambicus—White-naped Roller. Not common. I have met with only single birds here and there. Although it is such a brilliantly coloured bird when handled, it appears brown when seen perched on a tree.

68. Lophoceros monteiri—Monteiro's Hornbill. Not uncommon round Okanjande. Usually to be found in pairs. It has a loud call, and looks very strange as it gives vent to it, bobbing up and down in a most ludicrous manner. When I left Okanjande in May this species was common, but since my return in September I have not seen a single individual.

69. Lophoceros leucomelas—Yellow-billed Hornbill. I did not meet with this species till May, when, just before I left Okanjande, I secured a single specimen. I then went to Outjo, where I found it to be the common Hornbill of the district, going about in flocks of six or seven, following each other in single file, from tree to tree, with a dipping flight. On my return to Okanjande in September I found it had become quite common there. Its note almost exactly resembles that of the next species.

70. Lophoceros damarensis — Damara Hornbill. This species is not common, and I have met with it only along the banks of rivers, where it frequents the large camel-thorn trees. Mr. Austin Roberts, of the Transvaal Museum, informs me that he has written an article on the status of this species and erythrorhynchus, so I will not say much on that question here. But I might, however, point out that some specimens shot locally might be damarensis, others again erythrorhynchus, and some examples are intermediate. While at Otavifontein the form appeared to be erythrorhynchus only. There it was very common, and to be seen in large numbers frequenting the slaughter places and offal heaps, presumably in search of insects. At times it feeds a lot on the ground, digging with its bill amongst the debris of decayed leaves, etc. The notes of all three of the species seen in this country are very similar.

71. Dicrocercus hirundineus—Swallow-tailed Bee-eater. I found this species common at Okanjande and Outjo from March to July, but since my return to the former place I have not seen a single example. It is usually to be seen in pairs, sitting on some convenient perch, from thence flying off to seize some passing insect.

72. Merops apiaster—European Bee-eater. In March and April this species was not uncommon around Okanjande, occurring in large flocks.

73. Upupa africana—African Hoopoe. This species was common in both the Outjo and Okanjande districts from March till I left in July, but since my return I have not observed it.

74. Irrisor erythrorhynchus damarensis—Damara Wood-Hoopoe. This species is rather scarce. I only met with it on two occasions, in the Okanjande district. Those I saw were in flocks of six or seven, and in their habits appeared to resemble the common wood-hoopoe. They had the same note, but the very long tail, straight bill, and large white spots on the wings are very distinct.

75. Rhinopomastus cyanomelas — Scimitar-billed Wood-Hoopoe. Common everywhere in the thorn-bush. During the breeding season the males have a habit of sitting on the top of some dead tree and calling loudly, very like the Black Cuckoo.

76. Caprimulgus rufigena—Rufous-cheeked Night-jar. This is the only species of nightjar I have secured specimens of; it appears to be fairly numerous.

77. Apus barbatus—Black Swift. Fairly common during the summer and autumn seasons.

78. Apus caffer—African White-rumped Swift. Common, nesting under the covers of the buildings in the villages.

79. Riparia fuligula anderssoni—Damara Rock-Martin. Common and resident.

80. Hirundo dimidiata—Pearl-breasted Swallow. I have seen a few of these birds round Okanjande in March, April, and September, but I have not passed a summer in the country and cannot say how common they may be there.

81. Hirundo rustica—European Swallow. Common during the summer (the winter-time of Europe).

82. Hirundo cucullata—Larger Stripe-breasted Swallow. Common during the summer months, building their nests under verandahs, etc.

83. Hirundo semirufa—Red-breasted Swallow. I have lately (September) seen a few of these beautiful swallows flying high overhead, with a slow, lazy flight.

84. Bradornis mariquensis—Mariqua Flycatcher. Very common everywhere and resident.

85. Lanioturdus torquatus—White-tailed Flycatcher. Common everywhere throughout the thorn-bush, going about in small family parties. It is a charmingly tame little bird, and when one is sitting down in the bush it will often come and hop about quite close and peer at you in a most curious manner. It seems to feed a good deal on the ground. It looks very pretty, the black wings with large white patches making them resemble butterflies. While hopping about, the short tail points straight down, and the head, with the feathers puffed up, looks large and out of proportion. It has a great variety of notes, mostly harsh and querulous, but they have one loud clear call, which resembles that of the Black-headed Oriole.

86. Batis molitor—White-flanked Flycatcher. Fairly common amongst the open thorn-bush.

87. Batis pririt—Pririt Flycatcher. About as common as the previous species, but frequenting rather thicker bush.

88. Tchitrea perspicillata—Paradise Flycatcher. I have seen only a few of these pretty flycatchers amongst the thick bush, along the river at Okanjande, during March and April.

89. Eurocephalus anguitimens—Smith's Wood-Shrike. I met with a few of these birds amongst the camel-thorn trees in the Outjo district, but have not seen it at Okanjande.

90. Nilaus brubru—Brubru Bush-Shrike. This species was common at Okanjande during March and April, after which it disappeared and I have not seen it since.

91. Pomatorhynchus australis — Three-streaked Bush-Shrike. Not uncommon, and closely resembling the common senegalus in call-notes and habits.

92. Laniarius atrococcineus — Crimson-breasted Bush-Shrike. Very common everywhere, and a most conspicuous bird, not trying to conceal itself in any way. The Germans call it "the empire bird," as it has the three colours of the German flag—black, white and red.

93. Lanius minor—Lesser Grey Shrike. When I arrived at Okanjande in March this species was very common, but disappeared by the end of April.

94. Lanius collurio—Red-backed Shrike. This species was common at Okanjande and disappeared at the same time as the previous species.

95. Corvus scapulatus—Pied Crow. As is the rule with this species, it is very local. I have not met with it at Okanjande, but saw a few in the Outjo district.

96. Heterocorax capensis—African Rook. Fairly common throughout the district.

97. Dicrurus afer—Fork-tailed Drongo. Common everywhere, but its call-note seems slightly different from what I have heard when in the eastern Cape Colony.

98. Oriolus oriolus—Golden Oriole. I have seen only a single specimen, a fine adult which I failed to secure.

99. Creatophora carunculata—Wattled Starling. I saw a fair number of these birds during April at Okanjande.

100. Cinnyricinclus verreauxi—Plum-coloured Starling. I met with a few flocks of this beautiful starling at Okanjande in April; they appeared to be migrating in a north-easterly direction.

101. Lamprocolius phœnicopterus bispecularis—Lesser Red-shouldered Glossy Starling. Very common everywhere, and to be seen in large flocks, especially round farms and villages.

102. Lamprotornis australis—Burchell's Glossy Starling. Not uncommon amongst the large camel-thorn trees along the water-courses.

103. Textor niger—Buffalo Weaver. Not uncommon at Okanjande, where its large untidy nest may be seen in numbers in the large camel-thorn trees.

104. Ploceipasser mahali—White-crowned Weaver-Bird. Very common everywhere. This bird has a very sweet song, especially in the early morning and evening. Some of the notes are very deep and mellow, and reminded me strongly of those of a nightingale. It is otherwise very noisy and pugnacious.

105. Sporopipes squamifrons damarensis—Damara Scaly-feathered Weaver. Very common everywhere.

106. Ploceus cabanisi—Cabanis' Weaver. I have seen a few black-faced weavers about, but have not been able to secure a specimen; I believe them to have belonged to this species.

107. Amadina erythrocephala—Red-headed Weaver-Finch. Common everywhere.

108. Pytilia afra—Red-faced Finch. Not uncommon, found usually in pairs frequenting the undergrowth.

109. Estrilda erythronotus—Black-cheeked Waxbill. Not uncommon, going about in small family parties.

110. Uræginthus granatinus—Violet-eared Waxbill. Fairly common and usually found in pairs.

111. Tetrænura regia — Shaft-tailed Widow-Bird. Common in the vicinity of farms and villages.

112. Steganura paradisea—Paradise Widow-Bird. Not so common as the last-named species but fairly generally distributed.

113. Passer griseus—Grey-headed Sparrow. Fairly common; found out in the veld as well as near civilization.

114. Passer melanurus damarensis—Damara Cape Sparrow. Not common, I met with only a few specimens at Okanjande and Outjo.

115. Passer motitensis — Greater South African Sparrow. Very common everywhere; this is the common sparrow of this part of the world, where it is a familiar tame bird, living amongst the houses like the European house sparrow.

116. Philetærus socius — Sociable Weaver-Bird. Not uncommon on the whole, but local, not being found over large stretches of country; and yet in others one may see numbers of trees on which their huge nests have been built. I have noticed that the boom-slang seems to be partial to their nests, and I have several times seen the head and neck of one of these snakes protruding from one of their nest-holes; no doubt they prey on the eggs and young. The Rosy-faced Love-bird also sometimes occupies their quarters.

117. Poliospiza angolensis — Black-throated Seedeater. Very common, and may always be seen in large flocks watering at wells with all sorts of other birds. A Yellow Seedeater also occurs in small numbers but I have not yet obtained specimens (probably Serinus marshalli).

118. Emberiza flaviventris—Golden-breasted Bunting. Not very common, but I have seen a fair number, both at Outjo and Okanjande.

119. Fringillaria impetuani—Lark Bunting. Fairly common at Outjo, but I have not met with it at Okanjande.

120. Motacilla capensis—Cape Wagtail. Not common. I have seen only one or two specimens at Outjo, in the village.

121. Anthus leucophrys—Plain-backed Pipit. Not common. I have met with only a few at Okanjande.

122. Mirafra nævia—Dark-lined Lark. The commonest lark in this country, frequenting rough stony ground interspersed with grass and low thorn-bush. When flushed it usually perches on the tops of the thorn-trees. In the evening and early morning they utter a low, rather sweet song, and at this time they may often be seen chasing each other about.

123. Mirafra africanoides—Fawn-coloured Lark. Fairly common and fond of frequenting sandy roads. It is often seen perched on the top of a thorn-bush, uttering a low, rather feeble song.

124. Mirafra fringillaris—Finch-like Lark. Fairly common. In March and April, when they were breeding, their monotonous call could be heard all day long, and on moonlight nights, all night as well. This call they generally utter from the top of a thorn-tree, but sometimes on the wing.

125. Pinarocorys nigricans—Dusky Lark. Scarce. I have met with it only at Okanjande, where a few might be found on open ground in the vicinity of the camp. It has a very pipit-like flight and when flushed usually perches on a bush.

126. Pyrrhulauda verticalis—Grey-backed Lark. Fairly common on the "sand veld" both in the Outjo and Okanjande districts.

127. Pycnonotus capensis nigricans—Red-eyed Bulbul. Very common, especially in the vicinity of farms and villages.

128. Chalcomitra fusca—White-vented Sunbird. Not uncommon in the Outjo district, but I have never seen it in the Okanjande district.

129. Chalcomitra gutturalis — Scarlet-breasted Sunbird. I have met with this beautiful sunbird only at the Waterberg, and further north at Otavifontein I found it very common.

130. Cinnyris mariquensis — Southern Bifasciated Sunbird. In April, after we had had good rains and flowers were plentiful, this beautiful little bird was not uncommon, but lately I have not seen one.

131. Parus afer damarensis — Damara Grey Tit. Not uncommon.

132. Parisoma subcæruleum cinerascens—Damara Tit-Babbler. Common everywhere.

133. Anthoscopus minutus — Cape Penduline Tit. Fairly common.

134. Cisticola subruficapilla—Grey-backed Grass Warbler. A pair of grass warblers shot at Okanjande presumably belong to this species, but they were in such worn plumage that it is almost impossible to identify them properly. Grass warblers are rather scarce in this country, and this is the only form I have met with.

135. Calamonastes fasciolatus—Barred Wren-Warbler. Fairly common, and very wren-like in its habits, creeping about in the undergrowth, usually with its tail cocked up.

136. Prinia flavicans—Black-crested Wren-Warbler. Common everywhere.

137. Camaroptera griseoviridis sundevalli—Grey-backed Bush-Warbler. Observed in district.

138. Sylvietta rufescens—Crombec. Not uncommon. (The Damara form was named "ochrocarus" by Oberholser. EDD.)

139. Crateropus bicolor—Pied Babbler. Common, going about in parties of a dozen or more.

140. Chætops pycnopygius—Damara Rock-Jumper. I met with this species amongst the rocks and bush on the side of the Waterberg, where I saw one or two pairs. They flew little but hopped in a most wonderful way. The male utters a rather sweet, but short song. I secured a male.

141. Geocichla litsitsirupa—Groundscraper Thrush. This handsome thrush is not uncommon amongst the larger growth of trees along the water-courses, where it seems to feed mostly on the ground.

142. Monticola brevipes—Short-toed Rock Thrush. Fairly common in suitable localities. Although never far from rocky ground, I have very frequently seen it perching on trees amongst the bush.

143. Myrmecocichla formicivora—Ant-eating Chat. Not common. I have noticed it only in a few scattered localities where open grassy flats and ant-heaps were found.

144. Saxicola pileata—Capped Wheatear. Fairly common round the village at Outjo, but I have seen very few in Okanjande.

145. Saxicola familiaris galtoni—Galton's Chat. Found in the vicinity of all the rocky kopjes, and also frequenting the houses in the villages. A very tame little bird. At Okanjande a pair frequented the verandah of my quarters and often hopped in at the window to hunt insects round the room. They were quite fearless.

146. Erythropygia numida—Damara Ground Robin. Apparently rather rare. I procured only a single specimen at Okanjande, but it is a retiring bird, frequenting the thick undergrowth, and may easily escape observation.

147. Erythropygia pæna damarensis—Hartert's Ground Robin. Very common everywhere.

Stray Notes on Birds.

By C. F. M. Swynnerton, C.M.B.O.U., F.E.S., F.L.S.

Nightjars.

When a nightjar is settled, even conspicuously, in a path or open road, it is not easy to tell until one approaches it closely whether the dark object is a nightjar, a "cow-pat," or a stone. But let it rise, and the white tips or outer webs of the outer tail-feathers at once shine out as the bird, itself invisible, now against the nearer landscape suddenly spreads its tail in flight. I have found myself able to differentiate our commoner local species of Caprimulgus at night by means of the differences in these tail markings, and it is likely enough that they are useful to the birds themselves for recognition purposes.

Now, why do nightjars make a habit each night of settling on the open ground between their flights at insects? I think that one has only to recollect how at night one ducks down instinctively and remains squatted, when watching a bird or insect that is invisible except when seen against the sky, in order to know the reason. I tested this view when it occurred to me some years ago by watching nightjars for several nights in succession in an open road on which they were numerous, and I came to the conclusion that it was probably the correct one. The bird uses the ground as its perch in order to be able to detect its prey against the sky.

One other question is worth asking. Why the noiseless flight of nightjars? That of an owl is intelligible, for the small mammals that form its principal prey would be frightened to cover by wings that were noisy. But Copridæ and cockchafers don't worry about noises, and if you find a bunch of bananas or a mass of fallen peaches covered with the wariest of Noctuid moths, you may shout and clap your hands at them and fail to make them budge. Do owls attack nightjars? That might be a reason for noiselessness. It is possible that they do occasionally take one, but I have found no such remains in any owl's stomach, and I have watched one owl (Bubo maculosus) perched on a dead stump and intently watching the ground but taking no notice of the numerous nightjars not far away. This does not prove much; but the visibility of the latter as they dart after their prey must, in relation to such an enemy, more than counterbalance any advantage that might be gained from noiselessness. The correct view may be that moths, for example, deaf to all noises that do not ordinarily imply danger, are nevertheless sensitive to the vibration of wings, and that the explanation of the nightjar's noiselessness is, after all, the one that applies to the owl's. That moths *are* sensitive to certain kinds of vibration, just as bees are, may easily be proved by anyone who will take the trouble and repeatedly disturb only two or three of a number of moths that are feeding on fruit and notice the usual effect on the rest.

The excellent protection conferred on young nightjars in the down by the procryptic coloration of the latter, its mottlings matching the unevennesses of the bare ground in which the nestlings lie, is too well known to be worth mentioning here, except for the purpose of referring to the manner in which the down, all round the bird, seems to lie "to" the ground and, for visual purposes, join the bird on to it. It is, if anything, rather specially noticeable in Cosmetornis, I think, and the device is one that is still more perfectly represented in the insect-world, some protectively-coloured larvæ and the hairier species of ant-lions (the perfect insects) being shaded off in the same way into their surroundings by the "lie" of their peripheral hairs. It is true that in other larvæ a not dissimilar device is used to ward off ants.

PELECANUS ROSEUS, Gmel.

On September 9th, 1915, Mr. Hicks came on a flock of Eastern White Pelicans that appeared to contain from seventy to a hundred individuals. They were all together in an open, short-grassed vlei, close to the Umswirizwi River near Chirinda (in Southern Rhodesia), resting and engaged in preening their feathers. He shot two with a single bullet, so close-packed were they, and secured a third with his shotgun as they flew away overhead. One, that was only wounded, faced him and kept clapping its mandibles at him as he approached, producing a rattling sound.

He brought all to me. The measurements were as follows :

a. Male—Length in flesh 5 ft. 9½ in., wing 2 ft. 3½ in., tarsus 5·5 in., culmen (to external base of horny sheath) 15·9 in., tail 8·5 in.

b. Male—Length in flesh just 6 ft., wing 2 ft. 4 in., tarsus 5·25 in., culmen 17·1, tail 9·75.

c. Female—Length in flesh exactly 5 ft., wing 24·75 in., tarsus 5, culmen 12·3.

a's weight (a fraction under 19½ lbs.) was greater than *b*'s (17·25 lbs.) in spite of the latter's larger measurements.

Coloration.—The beautiful pink flush on the concealed portions of the feathers was by far the strongest in the smallest bird—the female—" c." In each case there was a good deal of red on the inside of the upper mandible. The colours of the soft parts, outside, were as follows :

Pouch, gamboge in " a " and " b " with a dash of naples yellow in it ; in " c " pale, whitish naples, tinged with lemon. Bill—much like the effect of red and blue pencil ; the midrib blue, and a long sharp-pointed wedge of blue running out from the base at each side of the upper mandible ; lower mandible blue, the whole commissure of both mandibles red and the rest of the upper mandible red. Roughly, upper one red with blue midrib and wedges, lower one blue with red commissure. This applies to " a " and " c," though the colours were somewhat paler and duller in the latter ; " b " the same, except that the red of the upper mandible was yellower in juxtaposition with the midrib.

Pouch-capacity.—I judged that the pouch of " a " *might* hold eight or a dozen pints of water ; I measured the capacity with a half-pint cup ; it held no fewer than eighty of these cups—that is, *five gallons*—and it would have taken another cupful at least to make it overflow. I emptied from " a's " pouch into " b's " and had to add nearly three pints more to bring the latter to overflowing point. When full, the lower mandible and pouch assumed a broad, deep boat-shape, and I was able, with assistance, to pick up the bird and carry it without bursting the pouch, now very thin and delicate-looking with distention yet tougher even than rubber. Presumably, in nature, the pouch would never become so distended as this as the weight of fish taken would not be equal to the weight of water; but the experiment illustrated nevertheless the immense strength and elasticity of the pouch and its wonderful capacity.

The occurrence of this pelican two hundred miles from the sea or an estuary is unusual and remarkable. The three stomachs were absolutely empty; and this, taken with the occupation of the birds when seen and the fact that the Umswirizwi—the only stream near—is at that point a mere brook, points to the probability that they were travelling and had merely halted to rest. The point they were at the time making for was, I imagine, the Sabi River, thirty miles to the west of where they were shot. W. L. Sclater (Fauna of S. Africa, vol. iv. p. 26) gave Lake Ngami and the lower Zambesi as the only places in the interior of S. Africa at which, so far as he was aware, this pelican had up to that time been found. I do not know of any later occurrences should such have been recorded.

My cat, even when hungry, objected strongly to scraps of pelican-meat offered him. By no stretch of imagination can a domestic cat be regarded as a potential enemy of a pelican, but I have had much evidence nevertheless that indications of this kind are not entirely valueless (*cf.* 'Ibis,' 1916, p. 541).

Janus.

Soon after the pelicans, came a Pearl-spotted Owl (Glaucidum perlatum) brought me alive by a native. It lived only a few days—long enough, however, to enable me to make a very striking observation. This was, that whenever the little owl turned round his head and slept, his face, now hidden, was replaced by the semblance of a yet more typically owl-like face depicted on the nape, which now of course usurped the usual position of the face, surmounting the breast. Two large black markings, rather elongated downwards at their inner ends, and surrounded by white feathers into which the brown feathers of the crown projected in a point exactly between the false eyes, produced the effect I have described. So good was the rough resemblance that when I first saw it, the light being somewhat dim, I commenced to offer the bird a piece of meat with my forceps. Then I saw there was something unusual and looked closer. The unusual thing had been that the "face" resembled that of such an owl as Syrnium woodfordi, with dark eyes and dark feathers immediately round them, rather than the pale eyes and face of Glaucidium itself. The fact that the feathers were puffed out in sleep, and so increased the apparent size of the head, added to this resemblance.

I found the resemblance, as seen in the living bird, too good to be able readily to regard it as a mere coincidence. If it should, actually, be as striking in birds of this species generally, I should be inclined to attribute a definite function to the markings. They would enable an enemy of small birds meeting with this diminutive owl when asleep, to recognise it readily *as an owl*. That this recognition might on occasions be useful to the owl can hardly be doubted. Apart from an owl's ability to "put up a fight," the one or two bird-eating animals to which I have offered the flesh of owls have shown a strong dislike for it, and it is possible that their view of it may be that of bird-enemies generally. In other words, the face on the nape is possibly mimicry—of self! On this view, however, any extra liability to mobbing would seem to be a minor consideration. Alleged to have the flight of a thrush and the note of a Golden Cuckoo, it is altogether a bird of queer resemblances. It measured 7·7 inches in the flesh, and the irides were gamboge.

The Birds of the Buffalo Basin, Cape Province.

1. Thrushes.

By Robert Godfrey.

The Buffalo Basin in Eastern Cape Colony is much smaller than either of the river basins—the Keiskama and the Great

Kei—with which it marches in its upper parts, but as an ornithological centre it is, thanks to the labours of Trevelyan and Pym at King Williamstown and of Rickard, Wood and Center at East London, much better known than its larger neighbours.

During a residence of eight years—from the end of 1907 to the beginning of 1916—at the Pirie mission station on the edge of the Pirie forest, I made continual observations on the birds of that locality, and in the columns of the "East London Daily Dispatch" I have lately been publishing a tentative list of "The Birds of the Buffalo Basin." On the basis of these papers I now desire to summarize our knowledge of bird-life of that area.

During my stay at Pirie I devoted my attention to the living birds in their native haunts, but I also welcomed every opportunity of handling specimens. Not having shot any birds myself, I relied on the courtesy of others, who hunted on my behalf and sent me the spoil, and I was fortunate in having a little army of collectors among the native children of Pirie, who for a long period came to me in an almost unbroken procession with the produce of their traps and their hunting. I have also to acknowledge the help, so readily given at all times, by the authorities of the Transvaal Museum.

Cape Thrush—Turdus olivaceus, *L.* Probably a bird of the forest in the olden days, the Cape Thrush still loves the security of the natural bush and is resident in the forest area at Pirie, occurring in the depths of the forest as well as along its borders. But it has long since ventured beyond the recesses of the forest and the wooded river-valleys and, at the present day, it is found even in gardens attached to human abodes. At Pirie it lives and rests beside the Girls' School and, in the centre of King Williamstown, it finds haunts suited to its retiring disposition. Mr. Wood of East London reckons that at least a dozen pairs have their permanent abode in the Park there.

On the ground the thrush stands with raised head and drooping tail, alert for any approaching danger; if satisfied that all is well, the bird lowers its head and raises its tail and proceeds in a half-hop, half-run style over the grass, halting ever and anon to cast a suspicious glance around or to catch sight of the end of a worm protruding from its burrow. Presently the thrush makes a sharp spring at its unsuspecting prey, and then fairly doubles itself up as, by a series of sudden jerks, it coaxes the stubborn worm from its hole; at a slight movement on the observer's part the bird is off, restless creature that it is, with a lowly-uttered "tsit" to the shelter of a bush or tree.

The shyness of the thrush is in great measure assumed, for, once the bird has chosen its feeding ground, it will return to the spot again and again, even though at every alarm—real or imagined—it may seek a place of safety.

Being mainly a ground-feeder, the Cape Thrush frequently falls a victim to the boys' traps; it is apparently unable to resist the tempting caterpillar bait, and as many as ten thrushes have been brought to me by the boys in the course of a week. This species, however, varies its diet with fruit in its season, and obtains berries from the trees by snatching them off in flight.

The Cape Thrush would not be true to his name were he not a songster. All the year round, with the exception of the midwinter month of June, he makes the forest ring before sunrise and again after sunset with his captivating outbursts of song. His bold, far-carrying notes—the main phrase of which may be variously rendered as "doiky, doiky" or "Do right! Do right!"—may occasionally be heard during the day also; but they do not, during the heat of the day, produce the same charm as at dawn and at dusk.

The alarm of the species, a loud bold note several times repeated, resembles that of the northern blackbird and is occasionally uttered under similar circumstances,—as when a bird, that has been flying silently along the border of some undergrowth, is at the end of the sheltering fence driven out into the open and dashes off with a screech.

The nesting-season lasts from the beginning of September to the end of April. I have, by watching a bird carrying nesting material, found a nest on the 11th of September, and I have had one with hard-set eggs brought me as late as April 13th. The nest, built generally in a thick bush or in the lower part of a tree, is composed externally of bright moss, pieces of stick, leaves and vegetable refuse: on this foundation rests the nest proper, a firm cup of mud and cow-dung plastered together with leaves, with fine twigs and lichens embedded in the brim, and green moss and twigs adorning the outside; the inner lining, sometimes fairly thick, is composed of withered leaves or layer upon layer of grass stems, the flat blades of grass gradually giving place to wiry stems, with perhaps a few fine roots, some feathery pappus and a little hair intermingled. The average internal measurements of the cup are $3\frac{3}{4}$ inches across by 2 inches deep.

The eggs, three in number as far as my Pirie experience goes, are green, dotted, spotted and blotched with brown of various shades and occasionally with purplish marks. In some eggs the surface is evenly and fairly closely covered with markings; in others, the greater part of the ground colour is visible, though hidden by blotches at the larger end.

Cape Rock Thrush—Monticola rupestris (*Vieill.*). On broken mountain-sides where rude boulders are intermingled and overtopped with bushes, the Cape Rock Thrush may be seen hopping from rock to rock or perching conspicuously on a dead tree. On the Pirie mountains the bird is locally distributed and probably resident. Below the forest, however, the bird is exceedingly rare and has on only one occasion, 21st July 1908, been brought me by the boys.

The Sentinel Rock Thrush—Monticola explorator (*Vieill.*) has so far escaped detection at Pirie, but in King Williamstown a pair was twice seen at the Reserve by Dr. Brownlee in the winter of 1915. On the foreshore at East London, both among the rocks and on the links, I have met with the species in June and July, and Mr. Wood records it from the West Bank in October also.

White-shouldered Bush Chat—Thamnolæa cinnamomeiventris (*L.*). This species is very sparingly distributed locally. Mr. John Wood of East London has occasionally, during the past twenty years, seen it at a kranz below Nahoon Island. Pym has found it on a kranz at Pirie also, but I have not found it nearer than Emgwali, which is beyond our limits.

[The Buff-streaked Chat — Thamnolæa bifasciata (*Temm.*) is recognized as an Eastern species in Cape Colony and is stated by Stark to be "not uncommon in the neighbourhood of King Williamstown." I have never seen the bird at Pirie, and know of no record from the limits of the Buffalo Basin. Stark's phrase should probably be taken in a wide sense. Three specimens were forwarded to me from the Winterberg in May, 1912.]

Ant-eating Chat — Myrmecocichla formicivora (*Vieill.*). This is, within the limits of the Buffalo Basin, little more than a straggler from the high veld. The King Williamstown Museum contains two specimens, one obtained by Mr. Pym, at Yellow woods, and the other forwarded by Miss Hudson from Kei Road; unfortunately neither specimen is dated.

Mr. John Wood has on a single occasion, near the mouth of the Keiskama, seen this bird at shore-level.

Sickle-winged Chat—Emarginata sinuata (*Sund.*). A male and a female taken at Kei Road in 1902, were presented to the King Williamstown Museum by Miss E. Hudson. Mr. John Wood records it from Chiselhurst, near East London, on 23rd August 1912, and remarks that at different times he has seen it in various parts of the district, though not often at the coast. In the hand, this chat is easily recognized by the very distinct narrowing of the inner web of the second primary towards the tip; but, in the field, it is liable to be confused with the Familiar Chat.

The Capped Wheatear—Saxicola pileata (*Gm.*) depends for a place in our list upon a single specimen forwarded to the King Williamstown Museum from Draaibosch by Miss Wilson, in 1905.

White-rumped Stonechat—Pratincola torquata (*L.*). The South African Stonechat, distinguished from the closely allied European species by its white rump, no more deserves the name of "Stonechat" than does the northern form; from its chosen haunts it should rather be called the "grass-chat." This species resides at Pirie all the year round, showing a preference for waste tracts and occurring in consequence more plentifully at the higher altitudes. Below the forest, however, pairs are scattered at intervals in suitable places, where long rank grass, with or without an admixture of low bush, predominates; they also frequent rough patches of land within the cultivated areas and sometimes live in close proximity to houses. Though generally content with a low perch, this bird has been seen at Pirie to settle on a high tree. At East London the stonechat is not uncommon and occurs even within the harbour area. Being of restless disposition and wont to delight in their rough call, they are seldom overlooked where present; they may even intrude themselves upon a traveller's notice by flying along the road in front of him in the fond belief that they are leading him past their preserves.

Like his northern ally, the male is a dandy and loves to display himself before his mate, spreading himself out so as to show to advantage his parti-coloured plumage. The song, of three or four notes, is varied and somewhat bold, with a short pause between the phrases; it is most noticeable in July, but goes on for the greater part of the year, though the exact dates have not been determined.

A nest of this species, found under a stone in a field, and containing three hard-set eggs, was brought with its owner on 21st December, 1911. It was a shallow cup, probably misshapen however in consequence of having been removed from its site, constructed of dry grasses; on one side a distinct outer barrier had been more tightly woven, and under the lining of the nest was a small quantity of hare's fur. The eggs were pale green, clouded all over with indistinct ashy markings, with a distinct zonal band of the same at the larger end.

Bush Blackcap — Lioptilus nigricapillus (*Vieill.*). Owing to the facilities for hiding in such a forest as that at Pirie, this silent and unobtrusive species rarely comes under notice. Yet it certainly nests in the forest, as a female with all the marks of brooding about her was brought by a boy on 18th November, 1910. Another was met with by Mr. John Ross on 23rd October, 1912. The species eluded my gaze during my stay at Pirie, but has come under my notice twice in Griqualand East. It hunts for its food in the thick undergrowth of the forest or of a fruit garden and pays scarcely any attention to an observer. The stomach of the female referred to was full of beetles.

Cape Robin Chat—Cossypha caffra (*L.*). The Cape Robin Chat is associated in my mind with a peaceful scene in the forest. I was hunting one April afternoon along the bed of a stream to find a stone suitable for a lintel, and I rested for a while in my search in order to see what life was about. The portion of the stream visible to me was a quiet pool three yards in diameter sheltered by a stout tree-trunk from the sun ; its upper edge was bordered by a rocky ledge across the bed of the stream, above which the watercourse was dry ; below the pool the watercourse for a few yards during which it was visible before taking a turn among the trees, was bare mud-covered rock. One of the fairy Pied Dragonflies (Chlorolestes tessellata) of the forest settled on an upright twig right opposite me and remained there as a feast for my eyes. A silent swift movement of some object passing beneath the prostrate trunk caught my eye, and the next moment a Cape Robin Chat perched on a slim branch lying athwart the pool. In its behaviour it was not unlike the northern robin. It kept its neck down, twisting it cautiously to ascertain if all was safe, raising its tail somewhat slowly and jerking its wings spasmodically. It flitted in perfect silence to another twig, a foot nearer me. I kept perfectly still, in the hope of seeing it feeding at its ease. But white jackets and helmets are not natural constituents of forest scenery, and my appearance proved too much for my visitor. Off it hurried with a distinct flutter of its wings, quite unlike its previous silent movements. Thereafter it could still be followed by the fluttering it made as it worked unseen about the bed of the stream, but it did not return to the pool. All was hushed again in my immediate neighbourhood save for the humming of an old mosquito gloating over the prospect of an unlooked-for meal.

Though one of our commonest birds, the Cape Robin Chat does not appear so to anyone unacquainted with its song. It lives amongst undergrowth and does not tolerate observation. In the search for its food, it hops over the ground by short stages, turning over withered leaves to discover the insects that may be skulking beneath, and picking up an occasional seed by the way ; but all the time the bird is ready at the slightest alarm to dart into the bushes. If in its hunt it spies the caterpillar bait of a boy's trap, it is almost certain to seize it and bring the death-dealing stone upon its head. This is one of the species on which the boys levy heavy toll. With the exception of November—an exception which is no doubt due to incomplete observation—the Cape Robin Chat sings all the year round. He loves for his music-stall a spot overgrown with bushes and trees, and there he will sit, maintaining his broken song and halting between the successive phrases. Often he varies his phrases, which consist of a few notes each, and keeps chattering to himself even in the heat. Though willing to sing at intervals all the day long, he shows himself off to special advantage at morn and at even ; in winter he sends a thrill of cheer through the woodland for a few minutes before the darkness falls. About the middle of September these birds retire for nesting-duties. I have neither seen nor handled the nest, but have found the young abroad on 23rd December.

Noisy Robin Chat—Cossypha bicolor (*Sparrm.*). Like the last species, the Noisy Robin Chat is frequently taken in the boys' traps during the non-breeding season; but it eludes them during the summer months. Though abundant in the forest, it is one of the most difficult of the forest denizens to observe. Repeatedly, when encamped by the forest verge, I have tried—but so far in vain—to track to their source certain loud cries which I am convinced are made by the species; in the dense forest one has little chance of coping with such a skulker as this. At East London, according to Mr. John Wood, this species is fairly common and in its song imitates such birds as the nightjar, the Turtle Dove, and the black-headed oriole.

Brown Robin Chat—Erythropygia signata (*Sund.*). Displaying the same disposition as the two preceding species, this Robin Chat would remain practically unnoticed did it not come to the boys' traps. Six specimens, between 1908 and 1912 inclusive, were brought to me by the boys, and a seventh was obtained for me by Mr. Bryce Ross. One of those brought had been eating tiny land-shells. The months in which these specimens have been obtained—April, May, August and December—indicate that in all probability this species is resident in the forest. In July 1912 Mr. Center showed me two specimens obtained at East London and informed me that the species was not uncommon in the bush there.

White-browed Ground Robin—Erythropygia leucophrys (*Vieill.*). This species occurs locally in the district on overgrown hillsides and by the margins of wooded rivers, being in spite of its name generally found about bushes. In May 1912 one visited the maize garden in front of the Pirie Mission house, frequenting the fruit trees there. Another that had been feeding on insects, was brought to me on 29th July 1910. In December I have found the species evidently nesting in the Cwencwe Valley. These various dates seem to indicate that this species is resident on the border of the forest. Towards the coast a specimen has been recorded from the Qwenegha by Mr. John Wood in June 1906, and from Kei Road on our eastern border a female was forwarded by Miss Hudson in May 1904 to our local Museum. In the breeding season this is a noisy bird, uttering a continuous rattling cry, somewhat like that of the northern mistle-thrush; it raises and lowers its tail continually and quivers it in convulsive responses to the rattle. I have found the young out of the nest on 10th December, but the nest itself I have not seen.

Cape Ground Robin—E. coryphæus (*Less.*). This species finds a place here on the strength of a single female obtained by Mr. Pym in 1902 within four miles of King Williamstown and now deposited in the Museum. Mr. Pym informs me that he saw others in July 1909 in the vicinity of Fort Cunynghame, beyond our limits.

The White-Starred Bush Robin—Tarsiger stellatus (*Vieill.*). This is yet another of these shy denizens of the forest, which fall, however, before the wiles of the youthful trapper. Between 1908 and 1913 inclusive, six specimens were obtained by my hunters in the winter months of May, June and July. A seventh specimen was shot by Mr. John Ross on 23rd November 1908. On the latter occasion he and I were far in the depth of the forest and were guided by the loud double note "ee-tchoo" of the bird to its haunt; later that same day we heard another calling. On a single occasion afterwards, 8th January 1913, I was again led by the call to the bird's haunt. The Pirie records indicate that the bird is resident, and two specimens brought in May were in immature plumage. Our local Museum contains a pair shot by Mr. Ranger at Kei Road on 18th August 1908.

[Familiar Chat—Phœnicurus familiaris (*Steph.*). In the adjoining basin of the Keiskama I have frequently met with chestnut-rumped chats, and within the strict limits of the Buffalo Basin I have observed a pair on a church-roof at Tynsha and seen one under the eaves of a native hut in the same location. As I have not handled a specimen, however, I prefer in the meantime to bracket this species.]

Description of a New Baboon from Rhodesia. By A. K. HAAGNER, F.Z.S., Director, National Zoological Gardens of South Africa, Pretoria.

(Plate III.)

Choiropithecus rhodesiæ, spec. nov.

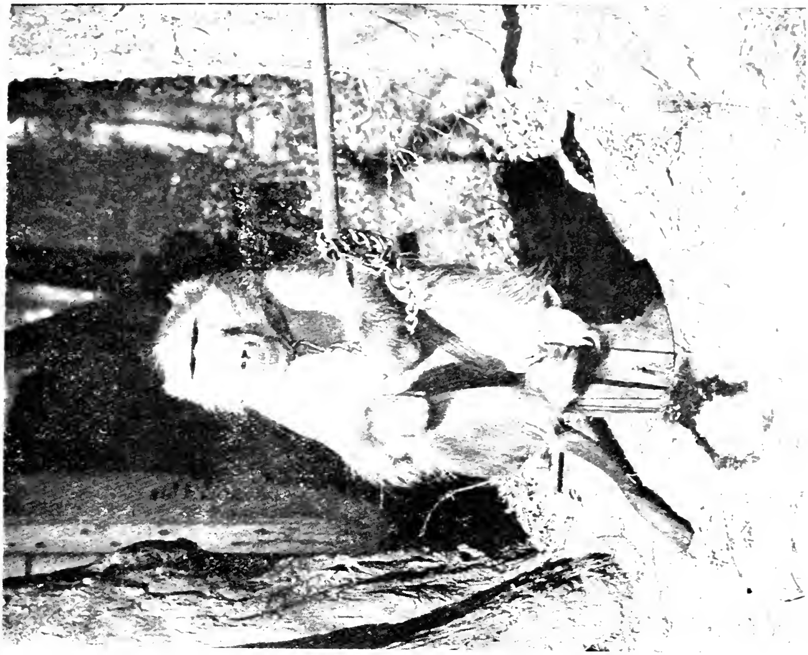
Description.—Upper parts of a grizzly olive-yellowish colour, much darker on the crown and along the spine, where the hairs are long and tipped with black, forming a slight mantle. Legs, feet and tail coloured like the sides, the individual hairs being ringed with black and yellow, the tips being pale yellow and the bases grey. Below pale greyish white, especially the chin, lower cheeks and throat, insides of the legs, belly and a patch behind each arm-pit: chest speckly. Muzzle somewhat lengthened and pointed, more resembling that of the Chacma, and not short and rounded like that of the Yellow Baboon. Length of snout from tip of nose to frontal ridge between eyes 5 inches. Length of fore-arm from tip of middle finger to end of elbow $16\frac{1}{2}$ inches. Length of hand from tip of middle finger to metacarpal joint 6 inches. Length of top canines $2\frac{1}{8}$ inches. Ears rather small and almost hidden by the hair of the upper cheek.

Remarks.—This animal is bigger than any Chacma or Yellow Baboon we have ever possessed. In coloration the Rhodesian Baboon somewhat resembles the Yellow Baboon, but in build is much more like the Chacma. It lacks the darker tip to the tail often found with the latter animal, and has not black hands and feet. The cry of this species also differs somewhat from that of the Chacma, being shorter and more cough-like. This example was received in February 1913, along with two others from Central Rhodesia, and noticing well-marked differences from young Chacmas, I kept one to see whether these characters would persist in the adult animal. The example is now 5 years old and, I should say, fully adult; I am describing it as well as I can from a living specimen. I have been promised some skins and skulls from a friend at Marandellas in Mashonaland, who told me, before he saw our example, that their Baboon was different from the Chacma, and who says it is common in that neighbourhood, but not easy to obtain on account of its wariness and the hilly nature of the regions it frequents. I shall publish a supplementary description later, upon the receipt of more material.

Notes on the Larvæ, etc., of some Rhodesian Tenebrionidæ. By RUPERT W. JACK, F.E.S., Government Entomologist, S. Rhodesia.

(Plates IV.–VI.)

CERTAIN terrestrial members of the family Tenebrionidæ are of no small economic importance in Southern Rhodesia owing to attacks by either the adult beetles or the larvæ on crops. On this account they have been for some years past the subject of study by the entomological branch of the Agricultural Department at Salisbury, and as a result the life histories of several species have been elucidated. The larvæ of different genera have been found to present very definite characteristics, by which they can be recognized without difficulty; and, as the family has apparently been little studied with respect to the immature stages of the members, it is desired to place on record such morphological notes as have been made during the course of research carried out primarily in the interest of the farming community. The paper deals with larvæ belonging to the genera Psammodes, Distretus, Anomalipus, Gonocephalum (Opatrum), Emyon, Zophosis and Trachynotus. For the identification of the various species the writer is, with two exceptions, indebted to the courtesy of Dr. Péringuey, Director of the South African Museum. Trachynotus geniculatus, *Haag*, and Psammodes similis, *Pér.*, were identified through the agency of Dr. Guy Marshall at the British Museum.



RHODESIAN BABOON (*Choiropithecus rhodesiæ*).

In his classic *Genera des Coléoptères* Lacordaire gives the following general description of the larvæ of this family :—

* "Whatever may be the form of the perfect insects, and this form is often short, broad and bloated (ventrue), the larvæ are all very elongate, slender, subcylindrical or slightly flattened, and have at the same time a rigid appearance, owing to the horny or leathery shields which cover their segments, both above and beneath. The head, equally corneous, is convex above and the epistome is distinct. The mouth, a little inferior in position, consists of a labrum, two strong mandibles, bifid at their extremities, two maxillæ (mâchoires), crooked, free and terminated by a single spinous (spinulose) lobe or armed with a horny hook, and bearing palpi, consisting of three segments; finally, of a short mentum preceded by a fleshy tongue, somewhat projecting and bearing very small palpi consisting of two segments. The antennæ, inserted laterally near the base of the mandibles, are composed of four segments, of which the two intermediary ones are the longest. Organs of vision are often wanting; when they occur, their number varies from two to five. The prothorax is generally a little longer than the two remaining thoracic segments, which differ but little from the first eight segments of the abdomen. The last abdominal segment is distinguished from those preceding by its form and the projections, consisting frequently of two hooks, with which it is armed. Beneath, it is generally provided with a bifid nipple (mamelon), which is retractile and serves as a fulcrum for the larva during locomotion. The legs, more or less spinous, are composed of five joints, the last of which, representing the tarsus, is short and curved; the anterior pair are slightly larger and more robust than the others. The nine pairs of stigmata are situated, the first on the anterior edge of the mesothorax, the remainder at some distance from the anterior angles of the first eight abdominal segments."

The foregoing description, published in 1859, applies generally to all the known soil-inhabiting larvæ of Rhodesian

* Author's translation.

Tenebrionidae, and it is only necessary therefore to deal with the characteristics which distinguish the different species. The figures reproduced in the attached plates have all been drawn with the aid of the camera lucida from larvæ bred from ova deposited in confinement. It is a little unfortunate that, owing to some of the species of this family being exceedingly difficult to distinguish, Dr. Péringuey has, in one instance, been able to supply only a provisional determination. As this paper deals mainly with different genera, however, this is of less importance than would otherwise be the case.

The characteristics found most useful in distinguishing the larvæ of the different genera are :—

(1) The shape of the anterior tarsal claw.

(2) The anal segment, with regard to its form and the number, form, and disposition of the chitinous processes on its dorsal surface.

(3) The presence or absence of pseudopodia on the anal segment.

(4) The presence or absence of spines on the pseudopodia.

The term *pseudopodia* is used for the retractile processes termed "mamelon" by Lacordaire. Pseudopodia are present in all the genera dealt with in this paper, except Anomalipus. The larva of this genus is very distinct from allied forms.

In accordance with Lacordaire's classification the different genera fall into the following order :—

(1) Zophosis.—Species studied determined provisionally as Z. boiei, *Sol.* (Plate IV. fig. 5; Plate V. fig. 5; Plate VI. fig. 5).

Ovum.—Dimensions 1·7 mm. by ·6 mm. Opaque white; rounded at ends.

Larva.—Attains a length of 25 mm. Yellowish white to fuscous yellow in colour; somewhat flattened dorso-ventrally; constricted rather strongly between the abdominal segments. The mandibles project beyond the labrum. The anterior pair of legs, although noticeably stouter than the remaining pairs, are less fossorially developed than in many allied forms. Anterior tarsal claws simple, without projections. Spines on inner margin of the various segments of the leg as follows :—

Tarsal claw	none.
Tibia..............	4 to 6, usually 5 or 6, moderately slender, sharp.
Femur	6 to 10, as broad as long, blunt.
Trochanter	1 ; rarely wanting.

Dorsal surface of anal segment straight or slightly convex in profile, hairy ; chitinous processes in form of moderately slender spines, placed dorsally and rather irregularly disposed, being, however, absent from posterior margin ; pseudopodia pointed and prominent, armed with spines.

The larvæ are extremely active and have a curious habit, when touched or alarmed, of twisting themselves violently about for a few seconds after the manner of larvæ of the Dipterous family Therevidæ. This habit has not been noticed in connection with any other Tenebrionid larva.

The food of the larva consists mainly of decaying vegetable matter in the soil, but they will, like most members of the family, bore into potato tubers when available.

Life-history.—The beetles emerge mainly at the commencement of the wet season, but do not lay eggs until March or April. The larvæ feed up during the winter and pupate in October–November. There is thus one generation in the year. The beetles have been recorded as attacking maize seed in dry ground, and sometimes cause serious injury to newly planted tobacco. They have a great fondness for dead insects. The species is common on the diorite around Salisbury and on both sandstone and granite elsewhere.

(2) PSAMMODES.—Species studied determined as P. scrobicollis, *Fhs.*: and P. similis, *Péring.*

(*a*) P. scrobicollis (Plate IV. fig. 7; Plate V. fig. 7; Plate VI. fig. 7).

Ovum.—Dimensions 3·25 mm. × 1·4 mm. Opaque white; tapering slightly at ends.

Larva.—Attains a length of 65–70 mm. Colour yellowish white, to yellowish brown (older specimens), the more chitinous parts reddish brown. General form somewhat flattened dorso-ventrally and conspicuously segmented. The mandibles project beyond the labrum. Anterior pair of legs strongly fossorial. Anterior tarsi flat, broad and bifid owing to a strong projection on the outer margin (see Plate VI.). Spines on inner margin of legs :—

Tarsal claw ....none.
Tibia ....1, short and blunt.
Femur and trochanter. .numerous. short and flat, often much fused together.

Dorsal surface of anal segment convex in profile with a very slightly raised ridge on the posterior and latero-posterior margin, bearing very small chitinous processes; minute chitinous projections scattered over dorsal surface of segment: segment hairy: pseudopodia prominent and armed with spines: a rounded projection anterior to pseudopodium on each side also bears a number of spines.

(*b*) P. similis (Plate VI. fig. 8).

Ovum.—Dimensions 2·2 mm. by 1 mm.: similar to P. scrobicollis.

Larva.—Greatest length recorded 45 mm. In general characteristics similar to scrobicollis, but may be readily distinguished by the proportionately very much smaller projection on the outer margin of the anterior tarsi (see Plate VI. fig. 8).

NOTE. Larvæ have also been obtained from two other species, namely, P. pierreti, *Fhs.*, and P. batesi, *Haag*, but they failed to attain much growth. The form of the anterior tarsi in both these species approximates closely to that of P. scrobicollis of a similar age.

Psammodes larvæ are active grubs, strongly cannibalistic in confinement. They feed freely on the underground portions of plants and constitute a bad pest of tobacco, killing the plants by eating into the underground stems. They are very fond of potato tubers and have lived for two years in confinement on this diet.

Life-history.—Although no specimen has been reared in confinement from ovum to adult, the life-history of P. serobicollis has been followed by combined observation in the field and the laboratory. The adults emerge at the commencement of the rains and lay eggs at once. By the beginning of the wet season the larvæ are about 20–25 mm. in length, and a year later have attained a length of 45–50 mm. By the end of the last wet season the larvæ are practically full-grown and the adults emerge the next November, giving a cycle of three years. Larvæ collected in the field in January, when they are usually most conspicuous for the injuries they cause, are found in two sizes, namely, about 30 mm. and about 60 mm. Adults have been bred from the latter the following November and from the former a year later. Larvæ have been bred from ova in the laboratory to a length of 50 mm., taking two years to attain this size. The cycle of P. similis has not been elucidated. A bred larva attained a length of 45 mm. in two years. Growth in both species appears to take place mainly during the wet season.

Psammodes occurs mainly on sandy soils, whether on sandstone or granite. The larvæ have not been recorded as injurious in the diorite.

(3) DISTRETUS.—Species studied determined as D. amplipennis, *Fhs.* (Plate IV. fig. 8; Plate V. fig. 8; Plate VI. fig. 9).

Ovum.—Length 3·7 to 4 mm. Breadth 1·6 to 1·8 mm. Shining white: form, sub-cylindrical, abruptly rounded at ends.

Larva.—Greatest length recorded = 37 mm., but without doubt they attain a greater length and probably approximate 50 mm. when full-grown. Colour whitish to reddish yellow. General form, slightly flattened dorso-ventrally (less so than preceding genera); strongly segmented; a central band on each segment bears numerous moderately long reddish-yellow hairs, giving the larva a characteristic hairy appearance. Mandibles project in front of the labrum. Anterior pair of legs strongly fossorial. Anterior tarsi flat and broad, with a projection on the outer margin (see Plate VI. fig. 9). Spines on inner margin of anterior legs :—

Tarsal claw .... none.
Tibia .... 1, moderately prominent.
Femur and trochanter: numerous, short, flat, and often fused together.

Dorsal surface of anal segment concave in profile, owing to strong development of spine-bearing ridge on posterior and latero-posterior margin. Chitinous processes in the form of short, erect spines, extending roughly round the margin of the posterior half of the segment. Two terminal spines more strongly developed. Segment generally very hairy. Pseudopodia prominent and armed with spines ; a rounded projection anterior to pseudopodium on either side also bears a number of spines.

The larva shows great resemblance to that of Psammodes, but is readily distinguishable by its hairy appearance and the greater development of the spinous ridge on the hind margin of the anal segment.

The food habits of the larvæ are apparently similar to those of Psammodes. The full life-history of this species has not been followed, but the beetles emerge at the commencement of the rains and egg-laying takes place immediately. The genus is commonest on the sand veld, but occurs also on the diorite.

(4) TRACHYNOTUS.—Species studied determined as T. geniculatus, *Haag* (Plate IV. fig. 6; Plate V. fig. 6; Plate VI. fig. 6).

Ovum.—Dimensions 2 mm. × 1 mm. Opaque white ; tapering at ends.

Larva.—Attains a length of 30 mm. Colour whitish yellow (with more chitinous parts reddish yellow) to reddish yellow. General form very slightly flattened dorso-ventrally; less strongly constricted between the segments than in preceding genera. General appearance smooth. Mandibles project beyond labrum. Anterior pairs of legs strongly fossorial ; anterior tarsi without projection on outer margin. Spines on inner margin of anterior legs :—

Tarsal claw	1, short and blunt, or more prominent.
Tibia	usually 2 (in one case 4), moderately prominent
Femur and trochanter..	numerous, short, flat, and generally much fused together.

Dorsal surface of anal segment concave in profile; well-developed ridge bearing chitinous processes extending round posterior and latero-posterior margin ; processes in form of short spines; terminal pair more strongly developed and fused together at base. A secondary armament of slender bristles extends round the same region below the spine-bearing ridge. Pseudopodia prominent and armed with spines, a rounded prominence bearing spines anterior to pseudopodium on either side.

NOTE. The larva of a species from Umtali determined by Dr. Péringuey as T. griseus, *Fhs.*, is very similar to that of T. geniculatus. Owing to the faulty preservation of this larva, however, accurate comparison is not possible.

The food habits of the larvæ are similar to those of Psammodes, and at least two species are even worse pests of tobacco. There is also reason to believe that these larvæ cause a mechanically-induced scab of potatoes by nibbling the tubers during growth.

Life-history.—The cycle generally occupies one year, but it is probable that occasional specimens may occupy two years in development. Unlike the other genera dealt with in this paper the adult beetles emerge in April, at the end of the rains. The ova are laid immediately and the larvæ feed up during both winter and summer.

This genus is very common on both the sand veld and the diorite.

(5) ANOMALIPUS.—Species studied determined as A. plebeius, *Péring.* (Plate IV. fig. 9; Plate V. fig. 9).

Ovum.—Dimensions 4·25 mm. by 2·25 mm. Shining white; form nearly cylindrical : abruptly rounded at ends.

Larva.—Greatest length not ascertained, but recorded up to 50 mm. Colour, younger specimens reddish brown; older specimens deep brown; very young specimens whitish. General form cylindrical, not constricted between the segments. General appearance smooth and shining. Mandibles project in front of labrum, but head more convex in profile than in preceding genera, so that the mouth-parts are carried at a lower angle and therefore less prominent. Anterior pair of legs fossorially developed: tarsal claw without projections. Anal segment entirely smooth except for minute punctation, and shaped like the pointed end of a fowl's egg; pseudopodia wanting.

The larva of Anomalipus is entirely distinct from that of other known Tenebrionidæ. The comparatively large size of the ovum is also worthy of note.

The food habits of the larvæ are not well known; they will eat potato tubers. The life-history has also not been followed, but the adults emerge and the ova are laid at the commencement of the rains.

(6) GONOCEPHALUM.—Species studied determined as G. æquale, *Er.*, and G. simplex, *F.*

(*a*) G. æquale.

Ovum.—Dimensions 0·87 mm. by 0·54 mm. Opaque white; rounded.

Larva.—From adults apparently indistinguishable from one another two distinct types of larvæ have been bred.

Whether this indicates two distinct species of Gonocephalum or not it is difficult to say. The larvæ are here described as Type No. 1 and No. 2.

Type No. 1. (Plate IV. fig. 1; Plate V. fig. 1; Plate VI. fig. 1).

Attains a length of 18–20 mm. Colour usually whitish yellow, but may be more or less tinged with a smoky hue. General form nearly cylindrical, not constricted between the segments. General appearance smooth and shiny. Mandibles not projecting beyond the labrum. Anterior pair of legs strongly fossorial; anterior tarsi without marginal projections other than basal spines. Spines on inner margin of anterior legs :—

Tarsal claw........	1, at base, moderately prominent (note also one projection short and rounded, on outer side of claw at base).
Tibia	1 to 3, usually 2, moderately slender and sharp.
Femur............	2 to 3, short and blunt.
Trochanter	2, short and blunt.

Dorsal surface of anal segment concave in profile; chitinous projections on posterior and latero-posterior margin mainly in form of stout spines and moderately numerous (14–20). Pseudopodia prominent and not armed with spines.

Type No. 2. (Plate IV. fig. 2; Plate V. fig. 2; Plate VI. fig. 2).

Recorded up to 24 mm. in length, but specimen much distended; greatest length from living specimens 20 mm. Specimens nearing full growth are much darker than Type No. 1, especially on the dorsal surface, which is of a rich brown colour, the under parts being yellowish brown. Owing to the darkest coloration on each segment being sometimes confined to the middle region specimens may present a banded appearance. This type differs from No. 1 in the less marked fossorial development of the anterior pair of legs (see Plate VI. fig. 2), and in the paucity of the spines on the margin of the anal segment: in the specimens in our collection these number only three a side (see Plate IV. fig. 2). It is noteworthy that in these and other characteristics, Type No. 2 approaches nearer to the larva of G. simplex than to the commoner type of G. æquale larva. The spines on the inner margin of the anterior legs are as follows :—

Tarsal claw........	1, prominent (also one equally prominent on outer margin at base).
Tibia	3 to 4, moderately slender and sharp.
Femur	2, moderately prominent.
Trochanter	1, moderately prominent.

The food of G. æquale consists mainly of decaying vegetable matter, but they will also eat into certain seeds, notably wheat. This stage is of little economic importance in Rhodesia, as it is confined to the winter months. The beetles may do great damage to maize seed in dry land and to newly planted tobacco. They commonly eat into the stems of succulent plants.

Life-history.—The beetles emerge mainly at the commencement of the rains, but do not lay eggs until March-April, continuing, with decreasing fertility, throughout the winter. The larvæ feed up during the winter and pupate just before the next rains. The adults show considerable longevity, specimens having been kept for more than twelve months in confinement.

G. æquale abounds chiefly on the diorite, being relatively scarce on the sand veld.

(*b*) G. simplex (Plate IV. fig. 3; Plate V. fig. 3; Plate VI. fig. 3).

Ovum.—Dimensions not recorded. Form similar to that of G. æquale.

Larva.—Greatest length not recorded. Bred specimens up to 15 mm. more slender than G. æquale of a similar length. Colour dark brown, some specimens appearing banded for same reason as G. æquale, Type No. 2. General appearance similar to G. æquale, Type No. 2. The femur of the anterior legs of this species is stouter in proportion to its length than that of G. æquale, Type No. 2, but the two species resemble each other in the length of the tibia and the comparative smallness of the tarsal claw. The number of spines on the inner margin of the femur and trochanter and anterior legs cannot be relied upon altogether to distinguish species as they are not constant, although their limits of variability appear to be narrow. The specimens of this species in our collection show the formula 1, 3, 2, 2 : the extra spine on the trochanter is thus a point of difference, if constant, between the species and the second type of G. æquale larva. The spines on the margin of the anal segment vary from four to six (2 to 3 a side).

The larvæ appear to be more superficial in their habits than those of G. æquale and are found commonly on the surface of the soil under rubbish. They feed on decaying vegetable matter.

Life-history.—This has not been fully followed, but is without doubt similar to that of G. æquale. Larvæ in confinement attained nearly full growth in a few months during the winter.

The species occurs on all types of soil.

(7) EMYON.—Species studied determined as E. tristis. *Fhs.* (Plate IV. fig. 4; Plate V. fig. 4; Plate VI. fig. 4).

Ovum.—Dimensions not recorded; opaque white: rounded.

Larva.—Maximum length 20–22 mm. Colour dirty white to whitish yellow, sometimes a little smoky. General form nearly cylindrical, slightly constricted between the segments. General appearance rather dull owing to closely placed short hairs on body. Mandibles rather more projecting than those of Gonocephalum. Anterior pair of legs strongly fossorial; anterior tarsi without projections. The formula for the spines on the inner margin of the anterior legs is almost invariably 0, 1, 2, 2. The spine on the tibia is sharp and prominent, those on the femur and trochanter are merely broad flat chitinous processes. Dorsal surface of anal segment strongly concave and surrounded by a sharp ridge (spoon-shaped); chitinous projections on lateral margin in form of short blunt spines; two large stout recurved widely separated spines on posterior margin; pseudopodia prominent and without spines.

NOTE. The adults of this species, although answering accurately to Fåhraeus' description of E. tristis, average considerably larger in size. The dimensions given by the describer are 5 mm. × 2–2·5 mm. Salisbury specimens average 8 mm. × 4·5 mm., the smallest specimen in the collection being 6 mm. × 3 mm.

The habits of the larvæ and adults and the life-history are similar to those of G. æquale, with which this species is commonly associated in great numbers. Emyon tristis is, however, found more abundantly on the sand veld than G. æquale.

General Notes.

The eggs of all species studied are laid loosely in the soil. The newly hatched larvæ are comparatively soft and are different in form from older specimens, being stouter in proportion to their length. After a few days, however, they become chitinous and more elongate. The larvæ which attack crops are generally called "wire-worms" in Rhodesia owing to their resemblance to Elaterid larvæ. The term "Surface Beetles" is applied to Gonocephalum, Emyon, Zophosis, etc., which are chiefly conspicuous for their attacks in the adult stage on seeds, newly planted tobacco, etc. This name was originally applied by Lefroy to Opatrum (Gonocephalum) in India.

The difference in the various life-histories is very interesting, but it is a perplexing undertaking to attempt to understand the purpose of these variations. The emergence of the imago at the commencement of summer and the postponement of egg-laying until the first touch of autumn is in the air, as in the case of Gonocephalum, Emyon and Zophosis, is surely most unusual amongst insects. It is noteworthy, however, that all three species occur on the dioritic loam, which forms an exceedingly tenacious mud in the wet season, and it may be that this environment does not suit the young larvæ as well as dry conditions. Trachynotus lives over the wet season in the larval stage, but the larvæ have attained considerable growth before the rains start. The other species, which lay eggs at the beginning of the rains, are mainly denizens of the sand veld.

The following key shows at a glance the characteristics distinguishing the different species dealt with in this paper :—

KEY TO KNOWN LARVÆ OF RHODESIAN TERRESTRIAL TENEBRIONIDÆ.

A. Anal segment smooth, without spines; pseudopodia wanting; larvæ cylindrical.

Anomalipus plebeius, *Péring*.

AA. Anal segment bearing spines; pseudopodia present; larvæ subcylindrical or somewhat flattened.

B. Pseudopodia without spines.

C. Anal segment spoon-shaped ; two terminal spines on posterior margin large, recurved, and widely separate.

Emyon tristis, *Fhs.*

CC. Anal segment not spoon-shaped; spines roughly uniform in size.

Gonocephalum æquale, *Er.*, and
G. simplex, *F.*

BB. Pseudopodia bearing spines.

C. Anterior tarsal claw with a projection on outer margin.

D. Dorsal surface of anal segment distinctly hollow in profile, with a strongly raised ridge bearing spines on posterior and latero-posterior margin. Larva noticeably hairy.

Distretus amplipennis, *Fhs.*

DD. Dorsal surface of anal segment convex in profile with a slightly raised ridge, bearing very small chitinous processes on posterior and latero-posterior margin: general appearance smooth and shiny.

Psammodes scrobicollis, *Fhs.*
P. similis, *Péring.*
P. batesi, *Haag*, and
P. pierretti, *Fhs.*

CC. Anterior tarsal claw without projection on outer margin.

D. Dorsal surface of anal segment distinctly hollow in profile; posterior and latero-posterior margins with a raised ridge bearing spines.

Trachynotus geniculatus, *Haag*, and
T. griseus, *Fhs.*

DD. Dorsal surface of anal segment straight or convex in profile; no spine-bearing ridge on posterior and latero-posterior margin; posterior margin hairy without spines.

Zophosis boiei, *Sol.*

NOTES ON THE LARVÆ, ETC., OF SOME RHODESIAN TENEBRIONIDÆ.

EXPLANATION OF PLATES.

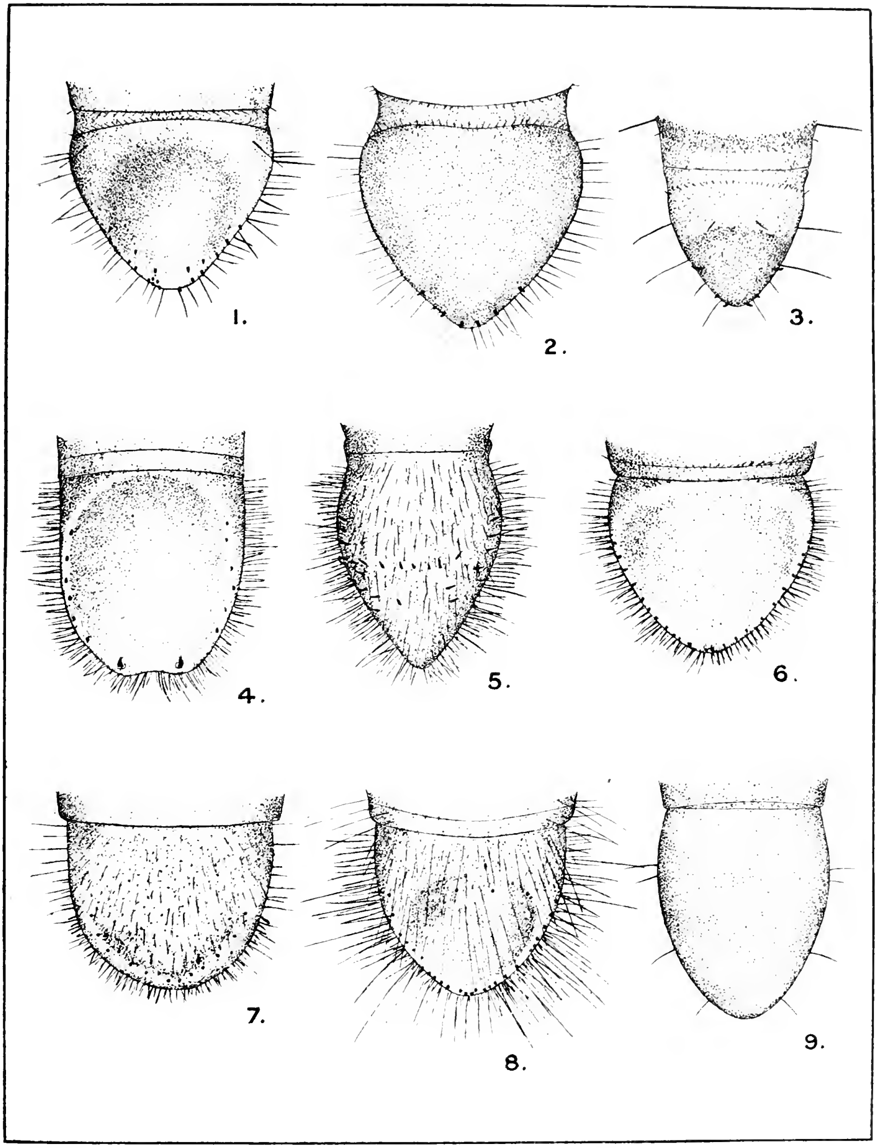
PLATE IV.

Fig. 1. Anal segment of larva of Gonocephalum æquale. Type No. 1.
2. Anal segment of larva of Gonocephalum æquale. Type No. 2.
3. Anal segment of larva of G. simplex.
4. „ „ „ Emyon tristis.
5. „ „ „ Zophosis boiei.
6. „ „ „ Trachynotus geniculatus.
7. „ „ „ Psammodes scrobicollis.
8. „ „ „ Distretus amplipennis.
9. „ „ „ Anomalipus.

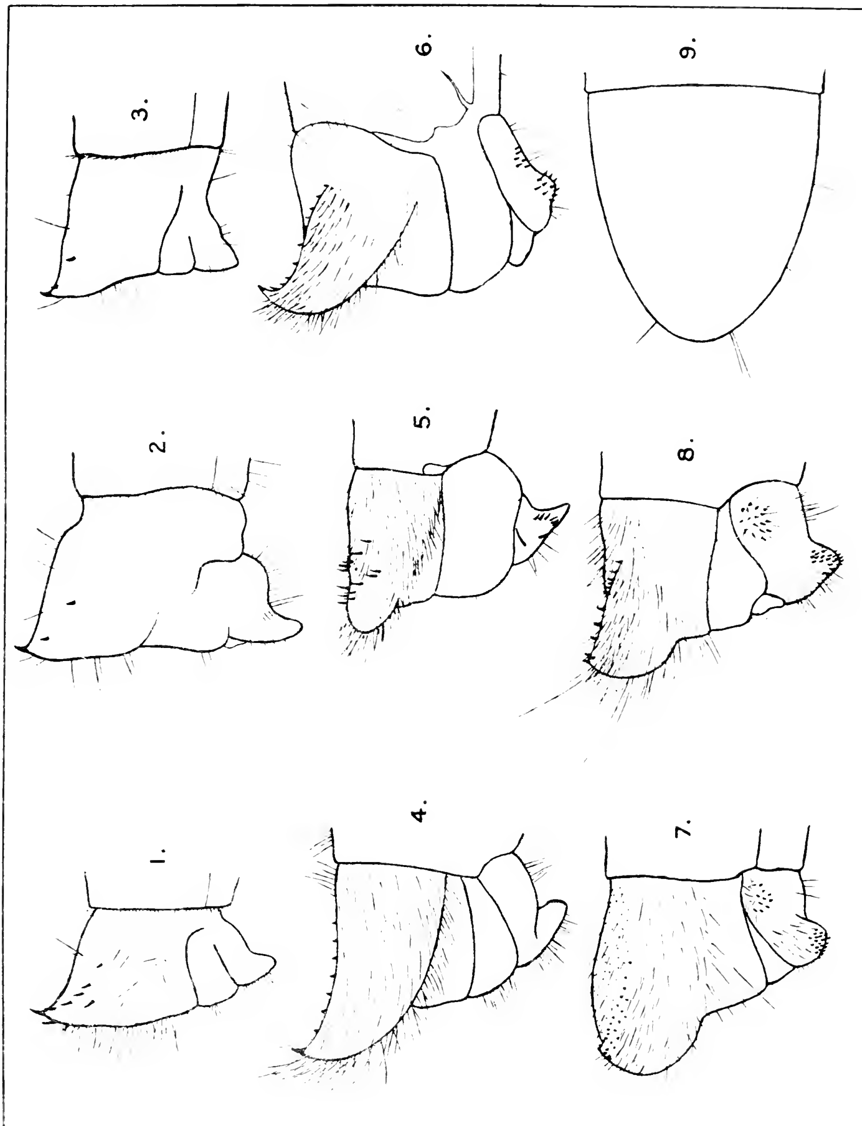
PLATE V. Lateral views of above in same order.

PLATE VI.

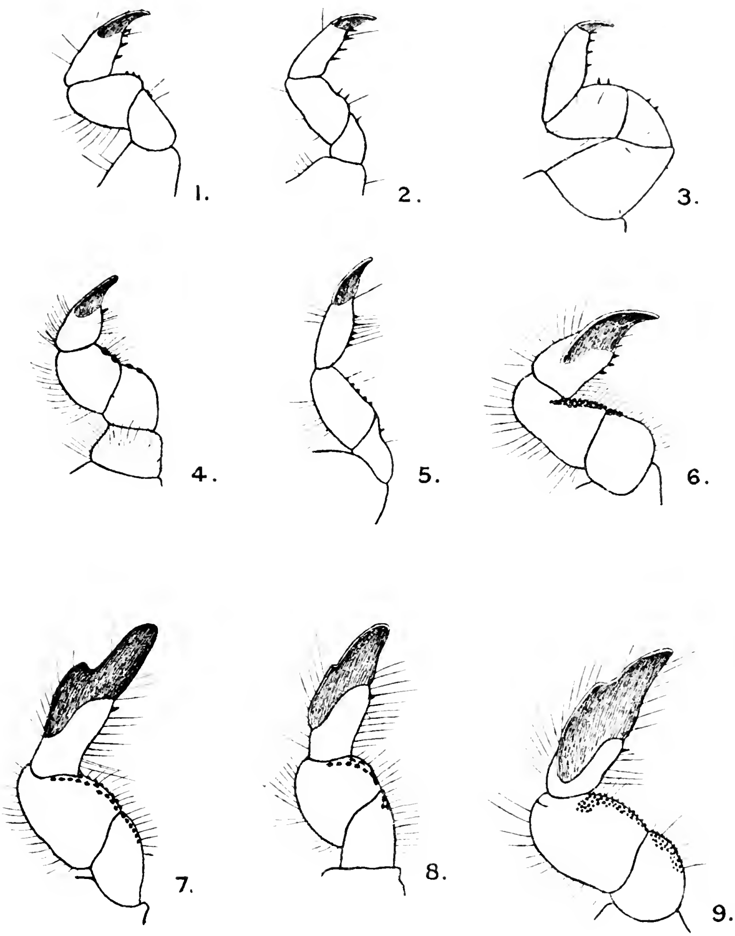
Fig. 1. Anterior leg of G. æquale. Type No. 1.
2. „ „ „ Type No. 2.
3. „ „ G. simplex.
4. „ „ E. tristis.
5. „ „ Z. boiei.
6. „ „ T. geniculatus.
7. „ „ P. scrobicollis.
8. „ „ P. similis.
9. „ „ D. amplipennis.



TERMINAL SEGMENTS (Dorsal View) OF LARVÆ OF RHODESIAN TENEBRIONIDÆ.



TERMINAL SEGMENTS (Lateral View) OF LARVÆ OF RHODESIAN TENEBRIONIDÆ.



ANTERIOR LEGS OF LARVÆ OF RHODESIAN TENEBRIONIDÆ.

*Comments on Dr. F. A. Dixey's paper on Seasonal Dimorphism in Butterflies and an Attempt to explain the Irregularities referred to**. By C. N. BARKER, F.E.S.

SEASONAL Dimorphism among butterflies, in those countries that possess well-defined wet and dry seasons, is a fact which has been proved again and again by the actual breeding of one form from eggs laid by another form ; in many cases of a strikingly different appearance. Perhaps the most extraordinary example yet known to us is the breeding, by Mr. G. A. K. Marshall in the year 1898, of Precis sesamus, *Trim.*, from eggs laid by P. octavia natalensis, *Staud.*; forms so unlike as to bear no resemblance to one another. The influences that produce seasonal dimorphism in butterflies are not, however, the same in all parts of the world. In Europe and other cold temperate regions, the experiments and researches of Standfuss, Weissmann, Merrifield and others, have proved that humidity has little or no influence in producing variation, temperature alone, or chiefly at any rate, being responsible. In semi-tropical or tropical countries, in which regular wet and dry seasons recur, humidity, or the lack of it, appears to be the principal exciting cause. It is, to my mind, however, exceedingly probable that the great differences of temperature between day and night, with accompanying dews, may have considerable influence in determining results by reaction upon the pupa. The greater or lesser degree of these factors, during the critical pupal period, may account for the appearance of the many transitional forms intermediate between the extreme wet and dry phases.

In some tropical countries rain prevails more or less the year through, as for instance in N.E. Sumatra, in some parts of West and Central Africa, in Singapore, and in some districts of Ceylon which have poorly defined seasons. In such countries it is, as might be expected, highly exceptional to meet with butterflies wearing the dry season

* Transactions of the Entomological Society, 1902, p. 189.

patterns of their representatives in countries with well-defined seasons.

Wet season forms are equally foreign to desert countries such as Sind in western India and other regions of a similar physical character.

Nevertheless there are a good many exceptions to these general rules. In N.E. Sumatra, Dr. L. Martins, an experienced entomologist and observer, records the fact that Catopsilia crocale, *Cr.*, and its dry season phase C. pomona, *L.*, both occur together and quite independently of the time of the year. Melanitis leda, *L.*, in both its wet and dry forms, is also resident in the island. At Karachi, which is a sea-port on the fringe of Sind, we have the assurance of Col. Swinhoe that he has taken all the seasonal forms of certain Eastern Teracoli and that he has also captured Byblia simplex, *Butler*, the supposed dry season form in India of B. ilithyia, *Drury*, practically all the year round. Again, in Aden Col. Yerbury correctly states that the wet, intermediate, and dry phases of Teracolus eupompe, T. evagore, etc., all occur, but that no seasonal significance can be attached to their occurrence as they co-exist. Terias, as Butler notes, like Teracolus, in very arid countries produces three phases of a species as co-existent varieties. Dr. Dixey sums up these irregularities as follows :—

"Statements of this kind, the list of which could be largely extended, go far to show that the case of Catopsilia pomona and C. crocale is by no means an isolated one and that just as there are regions in which more than one geographical form of a widely-ranging species may be found flying together, so there are districts of a greater or smaller extent where diverse forms of a species, confined for part of its range to definite seasons, may all occur simultaneously. No doubt the data are as yet insufficient for a complete explanation of these phenomena. It seems, however, clear that the forms or phases which are usually called 'seasonal' may occur under many diverse conditions and in many different proportions. It appears further that they do not fall into a regular system of succession, except in the presence of regular alternations of season, and not always then. I still venture to think that a probable view concerning many of them is that briefly expressed by me some years ago in 'Nature' (Vol. lx., 1899, p. 98), viz., that polymorphism, however it may have arisen, is capable of being brought more or less into relation with locality and season under the influence of natural selection. On the other hand, it is conceivable that in some cases at all events the forms in question may have first arisen as adaptations to the seasonal changes, and afterwards, in consequence of extending their range, or some other alteration of conditions, may have partly or entirely lost their correspondence therewith. These are questions that must, I think, for the present remain unanswered; though whatever the solution may be, there seems no need to anticipate that it will weaken the case for selective adaptation."

To my mind "Migration" is the simple and sufficient explanation of these irregularities in Seasonal Dimorphism, in certain regions, of species which are seasonally dimorphic in the greater part of their range. It will be noticed that with the exception of Melanitis leda, *L.*, all the species referred to by Dr. Dixey belong to the subfamily Pierinæ.

Mr. Distant in "Rhopalocera Malayana," discussing the habits of the Pierinæ (page 285), recounts the following instances to illustrate their proclivities as migrants, quoting Mr. Jones' account of swarms of Terias lisa which visited Bermuda in October 1874: "Several persons living on the North side of the main island perceived, as they thought, a cloud coming over from the N.W. which drew nearer and nearer to the shore, on reaching which it divided into two parts, one of which went eastward and the other westward, gradually falling upon the land. They were not long in ascertaining that what they had taken for a cloud was an immense concourse of T. lisa, *Boisd.*, which flitted about all the grassy open patches and cultivated grounds in a lazy manner as if fatigued after their long voyage over the deep. They did not stay long on the island." A similar phenomenon on the same island occurred on 10th October 1847. During

Mr. Spruce's sojourn in S. America he witnessed large flocks of butterflies pass across the Amazons, near the mouth of the Xungre in November 1849, in a direction from N.N.W. to S.S.E., evidently in the last stage of fatigue, "all of common white and orange yellow species." The little wind there was blew from E. to N.E., and therefore the butterflies steered their course at right angles to it.

In Ceylon Sir Emerson Tennent watched the "extraordinary sight of flights of these delicate creatures, generally of white and pale yellow hue, apparently miles in breadth and of such prodigious extension as to occupy hours and even days uninterruptedly in their passage." Darwin describes such another "swarm" which he witnessed when about 10 miles from San Blas. "Vast numbers of butterflies, in bands or flocks of countless myriads, extended as far as the eye could range. Even with a telescope it was not possible to see a space free from butterflies. The seamen cried out it was snowing butterflies"; and these again were Pierinæ, as Darwin found the most common butterfly to be a species of Colias.

The pseudonymous "Eha," who has written so pleasantly of Natural History in India, observes that "butterflies of some kinds,—especially those greenish-white ones of the family surnamed Callidryas [meaning Catopsilia; Callidryas is restricted to American species] . . . I have stood near one of the Parade-grounds at Poona and watched them. With scarce a pause to rest their wings or sip a flower, from 8 or 9 o'clock until the afternoon, as far as eye could reach, the host kept streaming past like the fugitive Gauls after one of Cæsar's great battles." There are many records of the great assemblages of migratory hosts of the genera Callidryas and Catopsilia. The following, quoted from the late Mr. Trimen's "S. African Butterflies" (Vol. iii, p. 190), recounts the late "Col. Bowker's observation of an immense migrating host of this butterfly in Basutoland." He gives it in Col. Bowker's own words as follows:—"During my trip to No-man's-land in March 1869, I crossed the Maluti Mountains at two different points, going and returning; and throughout the journey, whenever there was a gleam of sunshine between the prevalent showers, the exodus of (Catopsilia) florella and rhadia continued in one uninterrupted stream. These butterflies were to be seen in countless numbers, from the deepest and darkest valleys through which the Orange River forced its way, up to the highest peaks, 10,000 feet above the sea, *and all were steadily moving eastward*. Sometimes one of them would stop to take a sip from a tempting gladiolus, or even turn back a few yards for that purpose; but it would be only for a minute, and then off he would hurry again, as if fearful of being left behind by his comrades. I have noticed the same swarms in the Transkeian country and also in the Cape Colony. In the latter, I believe, other members of the Pieridæ were concerned." The above records might be greatly added to; but they are sufficient to show that some of the Pierinæ take only a second place to the locusts as migrants. The vastness of the range of such species as Terias hecabe, *L.*, and its allied species (so nearly allied as to make it very doubtful to my mind whether they should be recognized as anything more than local or geographical races of one species), of Catopsilia pomona, of C. pyranthe and others, alone is sufficient to demonstrate their capabilities as wanderers upon the face of the earth*. The Oriental regions are particularly favourable to the spread of butterflies, being under the influence of the N.E. Monsoon for

* I have referred to Melanitis leda, *L.*, as one of the few species other than those belonging to the Pierinæ included in Dr. Dixey's list of butterflies that exhibit irregularities in Seasonal Dimorphism. Like most of the Satyrinæ it is, seemingly, a feeble flyer, yet the following incident shows it is capable of sustained flight in spite of appearances to the contrary. Mr. Trimen records in a footnote to page 117 of "South African Butterflies":—"I captured a Melanitis (Gnophodes) parmeno (*Doubl.*) at sea about 190 miles due W. of Sierra Leone, and saw two others of same species on the 24th of November, 1871: the day was perfectly calm, but quite a number of Lepidoptera and other insects came about the ship. I was much surprised to find such shade inactive Satyrinæ as this butterfly and several of two species of Mycalesis among the visitors from the distant shore."

half the year and under that of the S.W. Monsoon for the other half. This probably produces a considerable intermingling of Eastern and Western forms. This disposition to range from district to district, now in an easterly, now in a westerly direction, not always as the wind blows, but influenced by it as to the general trend, is probably always existent. The migrations of great hosts is evidently of rarer occurrence and may be governed by the same laws, whatever they may be, that affect the movements of the locusts. Under these conditions it is hardly to be wondered at, that there is occasional instability among seasonally dimorphic forms in certain districts of India and elsewhere caused by the influx of new stock, interbreeding with that which has been longer resident, and thus interfering with the regular sequence of dimorphism. The areas affected by these migrants are naturally of a limited extent, and, as in the case of locusts, are of great consequence to one district, whilst leaving those adjacent unaffected. Hence we have the divergences in the testimony of observers in different parts of the same country, which are often so conflicting in their nature. For instance, we have the fact recorded by de Nicéville that the different forms of Catopsilia pyranthe, though corresponding to the seasons in some parts of their range, are independent of them in others. He goes on to say that it is not seasonally dimorphic in Sumatra as it is in India. In Ceylon, where four forms of this species are recorded by Moore, Manders says they appear all the year round as simple varieties. On the other hand, he says, "True C. pyranthe is not common in Missouri in the rains; the dry season form C. gnoma, *F.*, even less so. In the Dun both forms are common in their respective seasons." Both these places are in the district of Garhwal, N. India. Again we have the experience of Mr. Dudgeon in the Kangra Valley, W. Himalayas, who captured a large number of Catopsilia crocale, *Cr.*, and C. pomona, *F.*, on the same day (August 12th, 1900). They are stated to have formed part of a migratory flight which lasted all day. The case of Col. Yerbury's Aden and Col. Swinhoe's Karachi experiences is somewhat different from those that I have commented on above, but I think they are equally explicable on much the same lines. The physical characteristics of Aden and Karachi are very similar, both being sea-ports on the borders of desert hinterlands ; and both are virtually rainless regions. How, then, do we account for the simultaneous appearance in these places of many forms, that are seasonally dimorphic in other countries of their range?

Both Aden and Karachi are much in the nature of calm back-waters to the N.W. Monsoon current. They should therefore afford a tempting dumping or resting ground for stragglers of our migratory swarms, travelling from Africa to the East. The first few generations of newly arrived stock would retain in gradually diminishing degrees the disposition to vary, which their progenitors have acquired in the seasonally dimorphic regions of their origin. Again, the proximity of the sea to places like Aden and Karachi, modifies the physical (desert) conditions which obtain inland. Sea mists might have considerable influence on the larvæ and pupæ of recently arrived immigrants whose constitutional tendency to vary along certain lines is still active. These tendencies would be stimulated or otherwise by their *immediate environment* during the larval and pupal stages. If much exposed to mists rising from the sea, a larger proportion of wet and intermediate phases might be evolved. Per contra, if sheltered from these influences by intervening highlands, a larger proportion of dry forms might result.

In hazarding these somewhat speculative deductions, I know I am treading on dangerous ground, and I have as my sole justification the hope of stimulating interest and further enquiry into these abstruse problems of Nature. There are probably many diverse influences at work besides those I have touched upon to account for these irregularities. Mimetic adaptation, sexual selection, heredity, and many other factors may have their influence in the complex scheme of Nature which produces so many beautiful forms to delight the eye and perplex the mind.

Notes.

Two Rare Natal Butterflies. By Charles W. Morrison.

Deudorix dariaves.—On the 27th March, 1909, I met with this butterfly in the bush on Ridge Road, Durban, capturing a perfect male. During the next fortnight I took two more males and a perfect female. I showed my capture to the late Mr. A. D. Millar, and I have since seen in his collection, now in the Durban Museum, two worn specimens ticketed Umgeni, about a mile from where I took mine, and taken the same month and year.

I believe mine to be the first specimens to be taken in Natal, and, with the exception of those mentioned above, the only ones.

All my captures appeared flying down a narrow path in the bush at 3.30 in the afternoon and all settled on the same branch of a knobthorn tree, in a small opening in the bush, upon which the afternoon sun was shining brightly. I searched diligently all round this spot but could never find a trace of them anywhere else. In Trimen's work he describes one male sent to him from Delagoa Bay, but does not seem to have seen a female.

Iolaus æmulus.—Some thirty years ago the late Mr. A. D. Millar took a male of this butterfly at the junction of Currie and Montpellier Roads, Durban, at a time when the Berea was all bush and not as now all built upon. It was settled on mistletoe. During the next twenty years he took two other worn specimens at his residence on Ridge Road; one other specimen I heard was taken by a Miss Milne at Mount Edgecombe on the North Coast.

Mr. Millar's first capture was the type and named æmulus, I believe, by Mr. Butler. I know that Mr. Trimen considered it a sport or variety of aphnæoides, but why I cannot imagine, as there is very little real resemblance between the two. Probably the reason was that he had not seen a perfect specimen of the latter butterfly. I have splendid specimens of both sexes in my collection, taken near Weenen on the Tugela River.

On the 6th March, 1915, as I was returning home at midday, close to my home on Ridge Road a butterfly fluttered down at my feet from an Australian blackwood tree, and on picking it up I found it to be æmulus. Next day being Sunday, I went to see if I could find more and, on the same tree, found two females just emerged and drying themselves; I boxed these and proceeded to search further. I then discovered eight pupæ adhering to the trunk a few feet from the ground. These I took home and all emerged in a few days, four males and four females. Next day I found the larvæ at the root of the tree, just ascending the trunk. These I took home and all pupated the same day. It is interesting to note that none of these emerged, every-one being parasitized by a very minute black fly. This probably accounts for this butterfly's rarity. All along the top of the Berea bush for some miles, I found pupæ and skins during the next few days and took two more adults. The mistletoe would appear to be the food plant of this species. Next season (March and April 1916) I found no trace of this species, although I worked hard to that end.

A Question of Naming. By S. G. RICH, B.Sc.

We are now at the stage of biological advance in South Africa at which the accurate characterization of species is going on at a rapid rate. We are also confronted with chaos in common names, and the absence of such for many common plants and animals.

I wish to suggest that in the choosing of specific names the Native's names be used. In many cases they are pleasant to the ear, and their preservation is most desirable. We have had an immense number of species labelled "capensis," "caffer," "natalensis," "africanus" and the like, until we are overburdened with a few specific terms confusingly repeated.

I submit that such names as "umtsinsi" for the tree Eythrina caffra, "umwabe" for Chamaeleon pumilis, "intotoviana" for Zonocerus elegans, and the like, should not be lost. We shall see many of our species divided into two or more, and the use of these terms for the new ones is not difficult. I would suggest that the native name common in the district or one of the districts where an animal or plant is common should be used. For example, I am naming a new dragonfly, a Trithemis, from Natal, Trithemis ujekomanzi, using the Zulu name for dragonfly as the specific name (this in a paper shortly to be published).

For common names the native names have much to commend themselves. There is a common Gerbera near Pietermaritzburg known as "Hilton daisy" at Hilton Road, Natal, and as "Greytown daisy" at Greytown, Natal. I do not see any better way out of the difficulty than for all who are interested in naming this plant to adopt its native name. The common ill-smelling Acridiid, Zonocerus elegans, is called elegant grasshopper, dog locust, soldier grasshopper, German soldier, and also "intotoviana." The first four names are all not especially good, and the universal adoption of the last or Zulu name, will go far to produce uniformity and a well-sounding title.

When the South African Railways used Ixopo instead of Stuartstown, and recently changed several other stations near the edge of Pondoland, giving them native names, they indicated an advisable practice for naturalists to follow.

Extracts.

The Tampan, Ornithodorus moubata, the conveyer of relapsing fever to man :—

A native who had been sent into a warthog burrow was attacked by ticks with which it was infested. At Mwenga, N. Rhodesia, a specimen of O. moubata was removed from a warthog. (*Lloyd, L., Amer. Trop. Med. Parasit. Liverpool*, ix. 4, 1915.)

O. moubata has probably been introduced into Madagascar from East Africa. A company of Senegalese who travelled from Morudava to Majiuga were every one infested by the spirochaeti causing relapsing fever, excepting the European officer in command who, by taking precautions against the bite of the tick, was not attacked. The disease is particularly prevalent on the N.W. coast of Madagascar. (*Sudley, E. W., Bull. Soc. Path. Exot., Paris*, ix. 9, 1916.)

Mosquitoes.—That the larvæ of Culex can survive out of water under certain conditions for five days has been demonstrated by the fact that some taken from a ditch and placed between two layers of damp moss (1) in an uncovered box, (2) in a perforated box, (3) in an hermatically sealed box for this period became active, and appeared to develop normally. (*Legendre, J. C. R., Soc. Biol., Paris*, lxxxix. 1, 1916.)

In June 1915 workmen employed by the London Underground Electric Railway Company, when working at night in a "dead end" of the Highgate Station, 66 feet underground, were bitten by Culex pipiens, large numbers of which had bred in a water tank below the railway platform. (*MacGregor, M. E., Jl. Trop. Med. & Hygiene, London*, xix. 12, 1916.)

The House Fly.—According to Beal verminous enteritis of stock due to Spiroptera worms is transmitted by the house fly. The embryos of the worms pass out with the fæces and then enter the bodies of the fly maggots which infest the manure litter. The young worm reaches its final stage of development about the time the adult fly emerges. The worm passes from the body of the fly on to that of the horse, from whence it is licked in and passes to the stomach. It lives in the mucous membrane and also burrows channels in it. (*Beal, W. P., Ann. Rep. for* 1914, *Lond.* 1915.)

Examination at Mombassa of local natives who complained of intestinal troubles showed evidence of helminthiasis in 83 per cent. of the cases investigated. Ova of seven parasitic worms were found. Flies from the ward in which a number of cases were contracted were examined, and 10 per cent. contained ova of Trichocephalus dispar, T. saginata, and Ankylostoma duodenale, the first two being comparatively abundant. The ova of T. dispar appeared able to withstand putrefaction in dead flies for nearly two months. (*Shircore, J. O., Parasitology*, viii. 3, 1916).

Further observations were carried out during 1913 by Marchoux to demonstrate the transmission of leprosy by flies. The experiments showed that female flies were found to absorb more septic material than males, and the same material remained alive for a longer period in the intestine of the female. The bacilli could live in the digestive tract for at least four days, and it is therefore considered probable that infection can take place by the deposition of fresh excrement on wounds. (*Marchoux, E., Ann. Inst. Pasteur, Paris*, xxx. 2, 1916.)

Insect ailments.—Polyhedral diseases are known to occur naturally in many caterpillars. Several forms of disease can be distinguished, each of which is characterized by a special type of polyhedra. The size of the polyhedra varies very considerably in different species of insects, but there is a marked similarity in shape.

Wilt disease of gipsy moths, army worms, etc., is caused by a filterable virus, and it is believed that the polyhedra arise as a reaction against the invasion of the virus. The polyhedra are not living organisms. (*Glaser, R. W., and Chapman, J. W., Biol. Bull. Marine Biol. Lab. Woods Hole, Mass., U.S.A.*, xxx. 5, 1916.)

The dispersal of a Leaf Mite.—It has been supposed that birds, insects, and even the wind may be responsible for the distribution of the leaf-blister mite (Eriophyes gossypii), and it has also been believed that transportation from place to place may have been effected on cotton seed. In 1914 microscopic observation showed that the full-grown mites had a tendency to ascend to the tips of leaf-hairs and assume what appeared to be a waiting position. When a hair from a camel's hair brush was brought into contact with them, it was immediately grasped and the mite loosened its hold on the leaf-hair and allowed itself to be carried away. A mite could thus easily attach itself to an insect or bird. Early in 1916 a few cotton seeds were brought to Barbados from another island and planted in concrete tanks covered with cages of fine mesh wire. No cotton had been grown in these previously and no cotton is grown in the district. The first leaves of the plants from these seeds showed the characteristic signs of leaf-blister mite attack, and there seems to be no possibility that the mites could have found their way to these plants except on the seed. The disinfection of all cotton seed used for planting in a solution of one part corrosive sublimate to 1,000 parts water is therefore recommended. (*Agric. News, Barbados*, xv. *No.* 368, *3rd June* 1916, p. 186.)

Tsetse Flies.—Five species of Chalcidoid parasites were bred from the puparia of Glossina morsitans in Nyasaland, one of which is a hyper-parasite of G. morsitans through the ant Mutilla glossinæ. (*Waterston, J., Bull. Ent. Research, Lond.*, vi. 4, 1916.)

Insect Carriers of Fungus Disease.—Leafspot disease of peanuts (Arachis hypogaea), due to Cercospora personata, may be disseminated by insects. Positive tests were given by four orders of insects, namely, Orthoptera (grasshoppers and katydids), Lepidoptera (larvæ of Heliothis obsoleta), Coleoptera (Megilla maculata, Epicauta vittata, and Chauliognathus sp.), and Rhynchota (leaf-hoppers). Grasshoppers were found to be capable of carrying conidia on the surface of the body for very considerable distances, and the passage of the conidia through the alimentary tract of these insects did not affect their germination. The spores of Puccinia cassipes, Alternaria sp., and Fusarium sp. were also found in their excrement. The ineffectiveness of crop rotation, combined with seed treatment, in eliminating leafspot is thus probably due to the fact that wind and insects are disseminating agents. (*Wolf, F. A., Jl. Agric. Research, Washington, D.C.*, v. 19, 1916.)

Grasshoppers and Birds.—Of fifteen species of birds occurring in the Nicola Valley, British Columbia, the food was found to consist largely of grasshoppers, and in some cases grasshoppers formed 42 per cent. of the total. (*Taylor, L. E., Proc. Ent. Soc. Brit. Colmb. Victoria, No.* 7, 1915.)

Codling Moths and Temperature.—There is a type of injury in New York State due to larvæ hatching from eggs deposited in June or early July, after the fruit has attained a considerable size. This is said to be prevalent in localities where a large body of water prevented a marked rise of evening temperature in the spring. Eggs are rarely deposited when the evening temperature falls below 60° F. Records from inland districts, removed from the influence of water, have shown that at temperatures above 60° F. egg-laying proceeds normally. (*Felt, E. P., Jl. Econ. Ent. Concord*, ix. 1, 1916).

Röntgen Rays and Insect Control.—Under laboratory conditions tests made with a Röntgen-ray tube permitting a high-energy input and giving an intense and powerful radiation gave results which promise that the X-ray process may be successfully used in the treatment of cigars or tobacco infested with the cigarette beetle (Lasioderma serricorne). In treating the egg-stage heavier exposures are required to sterilise eggs which are near the hatching point than newly laid ones. A dosage equivalent to 150 milliampère minutes exposure with a spark-gap of 5·5 inches gave satisfactory results with eggs in tobacco placed 7·5 inches from the focal spot of the tube. With this exposure the eggs in which embryonic development was well advanced hatched, but in all cases where these larvæ were kept under observation they failed to reach the adult stage. In two separate experiments adults were given an exposure of 600 milliampère minutes, with a spark-gap of 5·5 inches, giving an approximate voltage of 65,000, with humidity at 57. The distance from the focal spot of the Röntgen tube was 7·5 inches. No effect on the length of life was apparent, as the beetles died at about the same rate as the same number of beetles kept as a control. Large numbers of eggs were deposited after exposure, but were infertile, though eggs from the control beetles hatched normally. Larvæ were given an exposure of 600 milliampère minutes, other conditions of the experiment being the same as with the adults. While no immediate effect was apparent, the treatment had the effect of stopping activity and development, the larvæ remained in a dormant condition for a prolonged period. All treated larvæ died before reaching the pupal stage. (*Runner, G. A., Jl. Agric. Research, Washington, D.C.*, vi., *No.* 11, 12*th June* 1916, pp. 383–388.)

An X-ray apparatus is used at a cigar factory at Tampa against Lasioderma serricorne (cigarette beetle). The machine can treat 40,000 cigars an hour. After being placed in boxes, they are put on a belt which travels through the machine a distance of 23 feet in 20 minutes. The apparatus contains two X-ray tubes, operating at 45,000 volts, and a current of 100 milliampères is passed through them. For 4½ minutes the cigars are exposed to the direct rays and to reflected rays for the greater part of 15 minutes. The machine is extremely simple in construction. It enables cigar-manufacturers to carry on work throughout the year, whereas, up to the present, it has been done chiefly before Christmas on account of the loss in large stocks due to infestation by L. serricorne. (*Skerett, R. C., Scientific American, N.Y.*, cxv., *No.* 15, 7*th Oct.* 1916, pp. 319 and 336.)

Locusts: Great Invasions.—Past history tells us to expect sudden invasion by vast swarms of flying locusts coming from parts unknown. There seems no suspicion that these unheralded migrations came from northern Africa, and the physical conditions of the continent seem to preclude such a contingency. On the other hand, all evidence goes to show that these locust phenomena originate in or near to the arid western core of South Africa. There is a general consensus of opinion amongst older inhabitants of the Cape Province that these invasions came from the north or north-west, of the Free State from the west, of the Transvaal from the south-west. All of the routes, or flight lines, lead to the southern Kalahari or to those parts where the Kalahari may be said to merge into the Great Karroo.

Whilst not attempting to deny that, under certain peculiarly favourable conditions, the interior of the Kalahari may at long intervals be the storm centre for locusts, I feel that it is rather upon the periphery of this region that locusts actually increase to great numbers and then overrun the countries where they do the maximum amount of damage but where they do not become permanently established. The actual point may be anywhere within the less arid parts, and this year it happens to have been the south-western portion of the Orange Free State.

It will be obvious that we have but to re-arrange our stage effects to reproduce one of those great invasions of the past out of current events. Antedate this outbreak to the days, not so very far distant, when locust visitations were received with no grave concern, when railways and telegraphs did not form a network over the country; allow Nature to take its course, and history would have repeated itself. To-day things are far different from what they were even thirty years ago, and it seems to be unlikely that South Africa will ever again be overrun by devastating swarms of winged locusts without due warning and without there being some opportunity afforded to stem the tide. In short, by efficiency—that is by preparedness and by keeping the whole of the suspected area under watchful observation,—there is much promise that the vast invasions of the past will be but matters of the past. (*Claude Fuller, Farmers' Weekly*, x., *No.* 254, 19*th Jan.* 1916, *Bloemfontein, S.A.*)

A Method of Preserving the Colours of Locusts and Grasshoppers.—The Entomologist of the Colombo Museum, after trying various chemicals such as alcohol, formalin, glycerine, benzine, etc., found calcium carbide the most satisfactory.

The insect to be treated should be cut along the underside of the body and all the inside scraped out. It should then be placed in an air-tight tin containing calcium carbide for a day or two before it is pinned, otherwise the acetylene gas given off by the carbide would corrode the pin.

It should be examined occasionally, for if left too long it becomes so brittle that it is almost impossible to pin it. When sufficiently dry it should be taken out and pinned. It will be found to retain its colour fairly well.

This method would probably also answer well for dragon-flies.

A German Stork.—The "Harrismith Chronicle" states that a stork has been picked up dead, killed by a hailstorm, on the farm of Messrs. Kahn and Jaffschitz, Bedford, in this district, on the leg of which is a ring marked "Vogelwarte, Rossitten, Germania, No. 10,222." It will be returned after the War.

Reviews and Notices of Natural History Publications.

Ornithology.

"*The Ibis.*" *A quarterly Journal of Ornithology.* January, April, July, and October, 1916.

In the January number we find, *inter alia*, a "Revision of the Genus Haplopelia," by David Bannerman, B.A., etc. He divides this African genus into two sections: A, including the Southern form H. larvata typicus; and B, including the various subspecies of H. simplex and several more.

The April number contains a paper on Birds collected in Uganda and British East Africa, with notes on their nesting and other habits (Part I) by Dr. V. G. L. van Someren, M.B.O.U. (plates 4 to 6). Plate 4 is a sketch-map of Uganda; plate 5 a photo half-tone of Barbatula jacksoni at its nesting hole; plate 6 a photo plate of Halcyon leucocephalus. Two thousand five hundred specimens were collected by Dr. van Someren and his brother, referable to 552 species and subspecies. Many South African species are, of course, included. The eggs of Larus cirrhocephalus were taken on the island of Lake Victoria, in August. The Crested Eagle, the Bateleur Eagle and the

Giant Eagle Owl were all found nesting. There is a good paper on "Bird-Parasites and Bird-Phylogeny" by Launcelot Harrison, B.Sc. He discusses the relations and biology of the Mallophaga group of insects (biting lice) which infest birds.

Mr. C. F. M. Swynnerton, F.L.S., F.E.S., etc., gives an interesting paper on the coloration of the mouths and eggs of birds. No. 1, the Mouths of Birds, is illustrated by a double coloured plate of the insides of certain birds' mouths. These have in many cases striking coloration.

The July number contains Part 2 of Dr. V. G. L. van Someren's paper on the Birds of Uganda and British East Africa, with plates 8 to 13. Plate 10 represents several examples of Corvus scapulatus on a rocky hillside.

There is a paper by Dr. A. G. Butler on "The assumption of Summer Plumage in Pyromelana oryx." Dr. Butler argues, from a specimen in his aviary, that the summer plumage is assumed by a gradual change in the coloration of the feathers, and not by a partial or complete moult.

The October number contains Part 2 of Swynnerton's paper "On the Coloration of Birds' Eggs." This is illustrated by a coloured plate of 25 eggs. The author carried out certain experiments, which he describes, showing that certain animals had certain preferences. He deals with the theory of coloration of eggs: their conspicuousness or otherwise, variability, etc.

Avicultural Magazine. Vol. VII., Nos. 1–12, November 1915 to October 1916.

It is proposed to notice only articles of S. African or general interest. The November number contains a short account of the breeding and rearing of a hybrid weaver-bird —a cross between a male Hyphantornis cucullata and a female H. spilonotus. Mr. Albert Pam gives us some notes on the transport of birds. The January 1916 number opens with an article on the genus Zosterops by Dr. A. G. Butler, which is illustrated by some pretty photographs of Zosterops capensis, the Cape White-eye; while Mr. F. E. Blaauw writes on "Sunbirds in their native haunts" in the February number, being a readable little account of the Sunbirds he saw on his visit to South Africa in 1914.

Mr. Blaauw gives us another little essay in the July number, "About Birds along the river near Oudtshoorn."

Mr. Blaauw in concluding his paper states that he had a very bad dinner in a very chilly room, and gives as his reason for remembering this, that *his* experience of South African dinners was that they were *always* bad, so that he could not make a mistake. He must have been extremely unlucky in the choice of his hotels, but what this has to do with Ornithology we do not know.

Mr. D. Seth Smith gives us some interesting notes from the London Zoological Gardens in the September number, while Dr. V. G. L. van Someren publishes an interesting article on the Lesser Red-winged Bush Shrike (Telephonus australis minor). This paper is illustrated by three fine photographs.

A. K. H.

Mammalia.

Proceedings of the Zoological Society of London for 1916.

The March number contains, *inter alia*, a description of a new Sable Antelope from Angola (Hippotragus niger variani) by Oldfield Thomas, with a woodcut (p. 300).

"Observations on the Intestinal Tract of Mammals," by Dr. P. Chalmers Mitchell (text-figs. 1–30).

"The Tympanic bulla in Hyænas," by R. I. Pocock.

The June number contains the following of interest to us: "Notes on the Sitatunga or Marsh Antelope of the Sesse Islands, Lake Victoria Nyanza," by Major Meinertzhagen.

"On the External Characters of the Mongooses (Mungostidæ)," by R. I. Pocock. This paper deals with the structure of the ear, vibrissæ, rhinarium, feet, the glandular anal sac and its functions, and the external genitalia. The African examples of Mungostidae examined were Helogale undulata from British East Africa, Ichneumia, Cynictis penicillata, and Suricata suricatta from South Africa, Ariela fasciata from the Sudan, Crossarchus obscurus from West Africa.

The genera Atilax and Ariela are resuscitated, and the reasons for so doing are detailed. The article is copiously illustrated (text-figures).

In the September number appears: "On the Structure of the Skull in Chrysochloris," by R. Broom, M.D., etc. (Plates 1 and 2); and in the December number "Scent Glands in Mammals," by R. I. Pocock (text-figures 1–12). In this article Mr. Pocock describes several discoveries of his, notably the inguinal glands of the aardvark (Orycteropus); these contain a yellow secretion smelling like that of the anal glands of a pole-cat (M. putorius). Digital glands were found on the fore and hind feet of a male South African Bush Pig (Potamochoerus choeropotamus), and a preputial gland was located in the Grysbok (Nototragus melanotus).

Sundry.

P. Z. S. 1916.—The March number contains a paper on "The Morphology of the Cyprinodont Fishes," by C. Tate Regan (Plates 1–4). The June number has an interesting speculative paper by J. C. Mottram, M.B., entitled "An Experimental Determination of the Factors which cause Patterns to appear conspicuous in Nature." He divides his paper in two parts, Morphology and Ethology.

Entomology.

Proceedings of the Zoological Society of London for 1916.

The March number contains the following:—

"On a Collection of Moths made in Somaliland by W. Feather," by Professor E. B. Poulton, M.A., F.R.S., F.Z.S. With descriptions of New Species by Sir G. F. Hampson, Bart., L. B. Prout, J. H. Durrant, and Dr. Karl Jordan. (Plates 1 and 2).

"Studies on the Anoplura and Mallophaga, being a Report upon a collection from the Mammals and Birds in the Society's Gardens; Part I. with a Preface." By Bruce F. Cummings, British Museum (Natural History) (text-figures 1–24). Part II. of this paper appears in the December number. The September number contains four papers on the Fly Investigation Reports carried out for the Zoological Society of London during 1915 :—

I. "Some Observations on the Life-History of the Blow-Fly and of the House-Fly," by Winifred H. Saunders.

II. "Trials for Catching, Repelling and Exterminating Flies in Houses," by Winifred H. Saunders.

III. "Investigations into Stable Manure to check the Breeding of House-Flies," by Winifred H. Saunders.

IV. "Some Enquiry into the Question of Baits and Poisons for Flies, being a Report on the Experimental Work, etc.," by Olive C. Lodge.

The December 1916 number contains :—

"On some Cryptostome Beetles in the Cambridge University Museum of Zoology," by S. Maulik, B.A., F.E.S.

"Notes on the Wasps of the Genus Pison and some Allied Genera," by Rowland E. Turner.

"Notes on a Collection of Heterocera made by Mr. W. Feather in British East Africa, 1911–13," by Lt.-Col. J. M. Fawcett. Plate 1 (coloured, of new species).

Annals of the South African Museum. Vol. XV., Part V.

(1) On some South African Ichneumonidæ in the collection of the South African Museum. By Claude Morley, F.E.S., F.Z.S., etc., issued 1st December, 1916. This contains descriptions of a number of new Ichneumonidæ from various parts of South Africa, and a bibliography of the main works on this group of the Hymenoptera.

(2) Descriptions of new or little-known Orthoptera in the collection of the South African Museum. By L. Péringuey, D.Sc., etc., issued 1st December, 1916. This paper deals with the sub-family Pneumorinæ of the Acriididæ, and three sub-families of the Locustidæ. Besides containing descriptions of genera and species, several of which are new, there are many interesting notes on the habits of these insects.

Annals of the South African Museum. Vol. XV., Part VI.

(1) On some of the Scoliidæ, mostly Elidinæ (Hymenoptera) in the South African Museum, issued 8th January, 1916. Contains descriptions of some new species.

(2) Description of a new species of Stomoxys (Diptera) from South Africa. By Dr. J. Villeneuve.

(3) A new species of Tachino-Oestrid from South Africa (Diptera). By Dr. J. Villeneuve, 8th December, 1916. A description of the species, with the note "One male from Port Elizabeth, Cape Province, alleged to have been bred from a honey-bee (J. W. FitzSimmons). This biological indication is the more interesting that nothing was hitherto known of the habits of the Tachino-Oestrid Diptera."

(4) A contribution to the study of the South African higher Myodarii (Diptera Calyptratæ) based mostly on the material in the South African Museum. By Dr. J. Villeneuve, 8th December, 1916. Contains descriptions of many new genera and species.

Obituary Notices.

1. H. E. Dresser. From "The Ibis" we note with regret the death of Henry Elles Dresser at the age of 77. One of the grand old type of English Naturalists, his name will live long as the author of the nine volume work "History of the Birds of Europe." He also wrote two folio monographs: one on the Meropidæ or Bee-eaters, and one on the Coraciidæ or Family of Rollers. Several other works of his need not concern us here.

2. Dr. D. G. Elliot, of New York, died on 22nd December, 1915, at the age of 80. He wrote, besides other works and papers, a series of Monographs illustrated with very fine coloured plates; these deal with the Pittidæ, Tetraonidæ, Phasianidæ, Paradiseidæ, and Bucerotidæ. His last work was a "Review of the Primates" in three large quarto volumes, begun in 1906 and finished in 1912, published by the American Museum.

3. Adolf Nehrkorn.—In the "Ardea: Tijdschrift de Nederlandsche Ornithologische Vereeniging," we notice that the veteran German Ornithologist Adolf Nehrkorn died on

the 8th April, 1916, at Brunswick, at the age of 72. He was chiefly noted for his wonderful collection of birds' eggs obtained from all over the world, which was—next to that of the British Museum—the largest in the world.

4. OTTO HERMAN.—This wonderful old Ornithologist died on the 27th December, 1914, aged 80 years. He was a Hungarian and the son of a surgeon, and being very interested in Natural History from his early youth, started his career as a taxidermist in the Museum of Siebenbergen in 1863. After some years in Parliament, where he fathered some sound laws which considerably advanced scientific research in Hungary, he founded in 1877 the official organ of the Royal Hungarian Museum of Natural History. He also organised the Royal Central Bureau of Ornithology, which did such good work in the study of migration and the economic value of the birds of the country. The organ of this Bureau, the "Aquila," was well known throughout the world, and has already run to twenty annual volumes. He was a broad-minded man, full of energy and enthusiasm for his beloved science.

5 & 6. Capt. GERALD LEGGE and Major C. H. T. WHITEHEAD.—From "The Ibis" of January 1916 we see that the War has further thinned the ranks of British ornithologists and claimed Capt. Legge and Major Whitehead. The latter served in South Africa during the Boer War, and wrote a paper in "The Ibis" for 1913 on the birds of the Orange River, although his main work was afterwards on the birds of India. He was only 34 when he fell. The former joined Woosnam in the famous expedition to Mount Ruwenzori in East Africa in 1905–6, and his name is commemorated by a new pipit then procured by him (Anthus leggei). In 1909 he again joined Woosnam in a trip to Lake Ngami in South Africa, which expedition was highly successful. He joined the South Staffordshires, and fell at the Dardanelles on 9th August, 1915.

7. ROLAND TRIMEN, F.R.S., died on 25th July, 1916, at Epsom at the age of 77. He was appointed Curator of the S. A. Museum, Cape Town, in 1873, retiring in 1895. His

work during his term of office there was mainly connected with the butterflies of South Africa, on which he published two important works. He was awarded the Darwin Medal of the Royal Society in 1910 for his work on mimicry, etc. in African lepidoptera. He was at one time a President of the London Entomological Society. He was the describer of the S. A. Racket-tailed Roller (Coracias spatulatus). He was an Honorary Member of the South African Ornithologists' Union.
A. K. H.

General Notices.

Importation of Game into the Transvaal.

Attention is drawn to the Administrator's notice No. 70 of 1916 dealing with regulations governing the importation into the Province of Transvaal of game or the horns, tusks, skins, or hides of game :—

The Administrator in Executive Committee is pleased, under the provisions of section *four* (1) (*k*) of the Game Preservation Ordinance, 1905, as amended from time to time, and section *eighty-one* of the South African Act, 1909, to make regulations governing the importation into the Province of Transvaal of game or the horns, tusks, skins, or hides of game as in the Schedule hereto.

Alfred B. Roberts,
Provincial Secretary.

Office of the Administrator of Transvaal,
Pretoria, 17th February, 1916.

(Here follow the details of the Schedule.)

Messrs. Witherby & Co. have been appointed European Agents for the "Journal of the Natural History Society of Siam." The work is illustrated with plates and figures, and deals with all branches of the Natural History of that country.

The Zoologist.—The well-known and old-established Natural History monthly, "The Zoologist," having been acquired by Messrs. Witherby & Co., will in future be incorporated with the illustrated monthly magazine, "British Birds," published by the same firm at 326 High Holborn.

Vol. I. No. 2 Price 7s. 6d.

THE

SOUTH AFRICAN JOURNAL

OF

NATURAL HISTORY

being
the official organ of the

SOUTH AFRICAN BIOLOGICAL SOCIETY

with which is incorporated the Journal of
The South African Ornithologists' Union.

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THE

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Vol. I SEPTEMBER, 1919. No. 2.

REPORT OF THE COUNCIL.

In reviewing the present state of the South African Biological Society I have much pleasure in saying that, circumstances being taken into consideration, the Council has every reason to be satisfied.

No doubt, the world-conflict has had its influence on the development of the Society, but when it is remembered that we received letters before the inauguration stating the time was not well chosen, which was in many ways true, we have certainly little reason to complain or regret the steps taken in forming the Society. The effect of the Great War has been felt in the publication of the Journal, both as regards cost and regular publication. Either of these influences could have been fatal to a young Society and we must thank our members for their patience. We hope our publications will appear at more regular intervals in future.

Membership.---We have lost one member this year through death, Dr. R. A. Buntine, who was a victim of the Galway Castle murder. Six members have definitely resigned; but these members were on the whole only interested in Biology in the abstract, and were never expected to take any active part. On the other hand, several of the members who have since joined are working biologists and thus the loss is fully compensated. One of our old members, Mr. D. Kehoe, M.R.C.V.S., has, unfortunately for the Society, left the country. To those who knew the Transvaal Biological Society in its earlier days, this loss will be fully appreciated, as Mr. Kehoe took a lively interest in the Society, being President of the Transvaal Biological Society in 1914 and of our Pretoria branch in 1917. We could rely on him for a really good paper, and he usually took a prominent part in the discussions. It is therefore with great pleasure that I announce the Council's decision to offer Mr. Kehoe Honorary Membership of the Society. We hope he will accept this as a small appreciation of his services to the former Transvaal Biological Society, and the present South African Biological Society.

Thirty-eight members are in arrear with their 1918 subscription, but of these some have been away or are still away on active service. Twenty-nine new members have joined, eight of whom were formerly members of the T.B.S. or the S.A.O.U. Our roll is now 160, a distinct increase notwithstanding the resignations and the drawbacks of the year under review. In addition several names have been mentioned as possible new members, and it seems desirable that more efforts should be made to increase the membership and so lead to the improvement and enlargement of our publications.

Publications.—On the whole I think that the publications have had a favourable reception. The Journal issued in May, 1918, was very much delayed, but well executed. The contents, however, were not as varied as it is hoped they will be in future numbers. Generally speaking, too few articles were submitted which were within the financial possibilities of the Society, and it was much to be regretted that a long and valuable paper had to be returned through lack of funds to illustrate it.

Articles of general interest are badly wanted, including some on Botany, a subject conspicuous by its absence in our issues. Of the articles published in the Journal and Bulletins, apart from the notes on various branches of Science, 13 were on insects, 7 on birds, 2 on mammals, 1 on reptiles, and 3 were papers on general subjects. Members contributing towards the Journal or Bulletin are asked to bear in mind that for the present attention should be given to the need of the amateur naturalist, who requires some guidance and stimulation towards the study of Biology. This stimulus is necessary owing to the regrettable lack of books dealing with our local flora and fauna. Such articles would not only increase our membership, but also cause our Society to fill a place not taken by any other Society in South Africa, while the publication of such is quite properly one of our objects.

Financial.—Although the cost of printing has been heavy, the balance to 30th September, 1918, showed a credit of £91 4s. 3d., and this, together with the outstanding subscriptions, gives us a substantial amount for 1919 expenditure.

Executive Committee.—There were five meetings of the Executive Committee. These were held in February, March, April, June and August, and were, on the whole, well attended. At one of these meetings the principle of founding a lantern-slide collection was adopted; for this I had much pleasure in offering my collection of about 500 slides as a nucleus. Lack of time has prevented us from making lists of the available slides, but details will be published in due course.

Library.—Our collection of books is still in a deplorable state; this year again only odd numbers were received, and there are several lacunæ in recent sets, as may be seen in the special report.

Pretoria Local Branch.—The Pretoria Branch held seven meetings during the year 1918, and an afternoon excursion was arranged to view the collection I made in Southern Rhodesia.

At the ordinary monthly meetings the following papers were read and discussed:

Date of Meeting. 1918.	*Author.*	*Subject.*
21 February.	C. Fuller.	The development of the respiratory system of termites.
21 March.	Dr. P. G. Cawston.	Bilharzia and related parasites.
21 March.	A. K. Haagner.	Exhibition of lantern slides with remarks on young animals in the zoo.
18 April.	Dr. E. M. Doidge.	Exhibition of a new bean disease.
18 April.	A. J. T. Janse.	New Saturniidæ from S. Rhodesia.
18 April.	C. Fuller.	The growth and development of a termite's antenna.
18 April.	A. Roberts.	Exhibition of new and interesting birds and mammals collected in the Cape Province.
18 April.	Dr. E. C. van Hoepen.	New fossil shells from the Cretaceous deposit in South Africa.
16 May.	Dr. H. G. Breyer.	A lecture on Mimicry.
16 July.	Dr. I. B. Pole-Evans.	A lecture on plant geography in S. Africa.
16 July.	A. J. T. Janse.	Notes and discussions on some new Hepialidæ.
22 August.	Dr. I. B. Pole-Evans.	Plant geography in S. Africa.
22 August.	Sir Arnold Theiler and D. Kehoe.	Some changes in the external sex characters of ostriches observed after removal of the reproductive organs.
19 September.	Dr. H. H. Green.	The behaviour of bacteria to arsenic.
19 September.	G. de Villiers de Kock.	A preliminary communication on the toxic effects produced by methylene blue in animals.

In general, the meetings were well attended and some particularly so.

Scott Memorial Medal.—In March, 1918, the first Scott Medal was presented to Sir Arnold Theiler, K.C.M.G. On this occasion, through the kindness of Dr. I. B. Pole-Evans and Staff, we were able to entertain the contributors to the fund resident in Pretoria, who are not members of the Society, in the beautiful grounds surrounding the offices of the Division of Botany. I have no doubt that this social function did much to bring the Society in touch with the Pretoria public.—(*A. J. T. Janse.*)

PRESIDENTIAL ADDRESS.

The Past and Present State of Entomological Research in South Africa.

If you will permit me, ladies and gentlemen, I will proceed with the Presidential Address, which it is customary to give at an Annual General Meeting such as this, and which is as a rule a short paper on a subject with which the office-bearer is more or less familiar.

It is now twenty years all but two months since I embarked upon the study of the insect-fauna of South Africa, and it is only natural that I should select an entomological subject. The subject is extensive if treated in detail, a task which is beyond me, and which would require a long preparation. I therefore intend to treat it in broad outlines only, but fully enough to show what has been done and, still better, I hope, what remains to be done.

Very few students nowadays attempt to deal with all the Orders of Insects of a country so extensive as South Africa. It may, therefore, be anticipated that I will not be able to name an entomologist who has even attempted to classify and study our insects of all orders and who has succeeded in laying the results of his labour before the public. It is true, on the other hand, that S. African Entomology owes much to the collector of insects of all orders, but in most cases earnest study is only done by the specialist. It will thus be necessary to deal with the orders separately and briefly, amplifying only the order I am mainly interested in.

Beginning at the lowest order, the *Thysanura,* of which the spring-tails and silverfish or bristle-tails are best known. Very little is published on this group in any country, and I do not know of anyone who has given attention to the S. African fauna.

The *Dermaptera* or earwigs of S. Africa have been dealt with by Verhoef; Distant also deals with them in a general way in his "Insecta Transvaliensia."

The *Orthoptera* (grasshoppers, hottentot gods, and stick-insects) are perhaps the best known of all the lower orders. However, a vast amount of work remains to be done, no monographic account has yet been given of the S. African species, and nothing is recorded concerning their histories. Prof. Rehn may be mentioned as having described a number of our *Orthoptera*. On the whole, however, fairly badly preserved material must have reached the different workers outside this country, judging by the orthopterous material found in the majority of the S. African Museums. Such is often in the same state as herbarium specimens are, as a rule, out of natural shape and with the colours changed to such a degree that it is often impossible to tell the species. If there were no good methods of preserving these insects, I would not make these remarks, but it is possible to preserve them in such a way that they resemble the living animal very well. Moreover, several Museums have no collection of *Orthoptera* at all. In many ways this is a very neglected group, which, from many points of view, deserves the thorough attention of the entomologist. At present I know of no taxonomist devoted to this group in S. Africa.

Platyaptera (bird-lice, stone-flies and white-ants) have of late received more attention from S. African entomologists, and of the whole order the termites have been studied best. In the early days (1858), H. A. Hagen monographed the termites of the world, and dealt with several African forms; G. D. Haviland published descriptions of eleven Natal termites in 1898, and Sjöstedt in 1900 published a monograph on the African termites. For a number of years Claude Fuller has given attention to this group, and published several papers on various subjects related to the white ants. In his example we can see what may be done with a group by one living in the country and studying its fauna; many errors will be rectified and many valuable observations made both as regards the biology and ontogeny of species. I think that his work on the anatomy, development and biology of termites surpasses anything that has been written on S. African white ants and perhaps many other groups of insects.

The *Odonata* in S. Africa, and the *Neuroptera* as well, have not been studied as much as they deserve. So far no special work on this well represented group has been published, although a classification has been given by Selys-Longchamps. A few years ago Mr. S. G. Rich, of Natal, commenced the study of the group. It is hoped he will give a monograph of the Neuroptera at some future date.

The *Plectoptera* (mayflies) and *Thysanoptera* (thrips) are not largely represented. However, as I do not know of anyone in S. Africa who has interested himself in these orders, it is possible that their study may yield a goodly number of new species.

The *Hemiptera* (bugs, froghoppers, coccids, aphids, etc.). It is surprising how little attention the *Hemiptera* have received from S. African workers in view of the wealth of species and their economic importance. It is estimated that the *Hemiptera* possibly outnumber even the *Lepidoptera*, of which about 6,000 species have already been described from this country. W. Distant has done a large amount of work on the Hemiptera-Homoptera, mainly the *Cicadidae,* and Schouteden has described and classified a number of *Heteroptera,* but these scattered papers have still to be brought into a compact form. Certain families have been dealt with or are still being studied by S. African entomologists. Mr. C. K. Brain will always be connected in one's mind with the study of S. African *Coccidae.* I understand Dr. E. Cogan may work at the *Cercopidae,* while Dr. Pettey is interesting himself with *Psyllidae* and *Tingitidae.* Several important families, however, are still untouched both as regards their classification and biology. It is the student resident in S. Africa who can do the most valuable work in this order, in view of the difficulties in preserving the pre-adult stages. Perhaps no other order has so many crop-destroying species, and it requires to be studied from the economic standpoint. There is room for the life-work of half a dozen energetic entomologists.

Small orders like the *Mecoptera* (*scorpion flies*) and the *Tricoptera* (caddisflies) have not found favour in the eyes of S. African entomologists, nor has much been published, as far as I know, in other countries, on our species.

Coleoptera (beetles). We now come to a very extensive group, the Coleoptera. It is difficult for me to give, at the present moment, an estimate of the number of species of beetles in this country, but it must certainly be somewhere near 20,000, if not more. These are insects easily collected and preserved, and, possibly, on this account the order has received considerable attention. Coleoptera are as remarkable for their shape as Lepidoptera are for their colour, and, very often, both these attractive qualities are united in beetles. The enumeration of the names of those who have endeavoured to bring into order the vast army of beetles would make a lengthy list, therefore I will but mention a few who have done rather prominent work. Boheman was perhaps the first systematist to catalogue S. African beetles in his classification of Wahlberg's collection (1848-57). After Boheman's time few worked at the whole order, and probably the only entomologist who has published extensively on the various families of Coleoptera is Dr. L. Peringuèy. It is to be regretted that this able authority is no longer in a position to continue his valuable series of monographs. His descriptive catalogues of the *Cicindelidae*, *Carabidae*, and *Scarabaeidae* will remain for many a day our standard references. The work on *Paussidae* and *Pselaphidae* by Dr. Peringuèy and A. Raffray are examples of what we require in the way of descriptive catalogues. Some extensive collections of this order are preserved in S. Africa, and of these Dr. Peringuèy's is perhaps the largest. It is to be hoped that this valuable private collection will not pass out of this country, and that a foresighted policy will secure its incorporation into the already large collection of the S. African Museum. Next to this unique collection comes, probably, that of the Transvaal Museum and the rather large collection of Cecil Barker, which has been secured by the Durban Museum. No doubt several other collections of beetles exist in S. Africa among private collectors. South African Museums have, on the whole, comparatively small collections. This is largely due, I think, to lack of accommodation. There is no doubt that much still remains to be done in this order, and that we need more students to follow up the work already accomplished. Seeing that many beetles are of economic interest, it is surprising that we know hardly anything about the life histories of the great majority of those in S. Africa.

Siphonoptera (fleas, etc.) and *Diptera* (flies). Little has been done with the members of these orders, though those of the latter are exceedingly abundant and of considerable economic importance. Only the more striking and larger species have been classified, and not one-tenth of what requires doing has been accomplished. At the present time we have no Dipterologist, as we have a Coleopterist like Dr. Peringuèy. Several European entomologists have studied our Diptera, of whom Loew, Herman, Bezzi, Villeneuf, Theobald, Austin and Ricardo are the best known. From an economic point of view the blood-sucking flies are certainly most important, and their classification and mode of life are being studied in connection with diseases by Mr. Bedford. Still, more workers will be required before the order can be monographed on the scale it deserves.

Lepidoptera. I will refrain from giving all the data in my possession with regard to the study of this order.

As the group is very important from many points of view, and as it is numerically one of the largest, I will, however, devote a little more space to it than I have to other orders. The number of species now described is nearly 6,000, but probably only one-fifth is catalogued.

Perhaps no order of insects is as dependent on varied vegetation to produce such a large number of species as we find in the butterflies and moths, and no fauna is perhaps so readily affected by the change of the flora as the Lepidoptera. Fortunately it is a group that attracts and always has attracted the attention of the entomologist, and of the butterflies comparatively few remain to be discovered in S. Africa. This we owe to Trimen's excellent monograph and to the more recent work on Aethiopean *Rhopalocera* by Prof. Aurivillius. However, the life-histories of ninety-five in every hundred species are unknown. Very few of our Museums have a really good collection of butterflies. The South African Museum stands in the front in this respect, as it contains the Trimen collection. Next comes the Transvaal Museum, where the *Rhopalocera* exhibit is conspicuous for its beautiful condition and its many rarities. Then we have the Millar collection, purchased by the Durban Museum; unfortunately, this collection, well preserved as many specimens are, is without locality labels, and though most specimens are from the coastlands of Natal, yet the scientific value is greatly diminished. Other S. African Museum collections consist of little more than a few show-specimens, which in many instances are anything but showy. It is indeed time that these different institutions receive facilities to obtain and preserve first-class collections before many of the most interesting forms have disappeared for ever.

In addition, several larger or smaller collections were made by private workers, the best being perhaps the one made by Mr. Feltham, of Johannesburg. Here, again, it is to be hoped that this collection will not be lost to a Government institution, where in the future it may have the care it deserves. My own collection, though fairly large, is still far from complete in *Rhopalocera.*

The study of the *Heterocera* or moths has been far more neglected than that of the butterflies, and no monograph has yet been attempted. Many of the bigger and more conspicuous moths were described or figured before 1850, but most of the work was done after that date. Some of the earlier writers on S. African moths were Fabricius (1775), Cramer (about 1780), Guenée (1850), Hübner, Drury and others.

The first attempt to catalogue the moths of the world was made by Francis Walker (1854 to 1866), and in his extensive work many S. African species were incorporated. In many ways this work is still useful, but had it never been published it might have been better, as the species described therein as new are usually insufficiently characterized and some are described half a dozen times, usually under several generic names, and in some cases even placed in different, rather remote, families. This will give an idea of the difficulties in recognising Walker's species, and perhaps the only merit of the work is that at the time it was fairly up to date and very few described species have been overlooked, thus making good the want of some of the very old works.

At about the same time (1853) Herrich-Schäffer published his "Aussereurop. Schmetterlinge," in which several species are described from S. Africa. About 1860, Wallengren gave some papers on new S. African Lepidoptera, and his descriptions are, for his time, about the best I have seen. Zeller, as early as 1839, did some good work on Microlepidoptera, and his Lepidoptera Microptera (1852) is very useful. Lederer published an excellent paper (1863) on the classification of the *Pyralidae,* which has been used and improved by later workers like Snellen, Meyrick and Hampson. Several S. African species were described in this work.

From 1870 the publications became too numerous and scattered to give anything approaching a complete list.

Mention must, however, be made of Felder's "Reise Novara" (1874), in which many new S. African species are figured, but not described. Several other longer or shorter papers were published by Aurivillius, Maassen and Weymer, Westwood, Butler, Druce, Distant and others, but no attempt was made to improve the classification of the group except in a few small families, and these classifications are now out of date.

The first Catalogue of S. African moths was started by Sir George Hampson. Unfortunately his time was too much occupied by the larger "Catalogue of the *Lepidoptera Phalaena*" to do more than the *Amatidae, Arctiadae, Noctuidae, Lymantriadae*, and *Hypsidae*, and all of these families have been substantially supplemented since the date of issue. In the above mentioned work a large number of new species are described from this country, and it is to be hoped, now the war is over, the remaining volumes will soon be issued.

A most excellent Revision and Monograph of the *Sphingidae* was published by the Hon. W. Rothschild and Dr. Jordan (1903), and several new species of S. African hawk-moths are described. During the last eight years a large number of new *Geometridae* have been described by Mr. L. B. Prout, and it is trusted this distinguished worker will find the time to give a new classification of the species of this difficult group.

Of the *Micro-Lepidoptera*, Lord Walsingham described a number of species (1881 and 1891), the types of which are in the S. African Museum. The majority of species and genera of this group we owe to the famous specialist, Mr. E. Meyrick, since 1908, when I had the privilege of sending my first specimens to him. By the generosity of this able worker practically all the type material of his S. African species is now in this country, and will form the foundation of any further work done on the group. What we owe to the careful work of Messrs. Meyrick, Prout and Sir George Hampson will only be fully appreciated, I think, by entomologists of a future generation.

A checklist of the S. African *Heterocera* and various papers on some of the families of moths have been prepared by myself, and I hope to bring before the Society a rather extensive paper on the *Notodontidae* in a few months time.

As regards local collections of S. African moths, my own is perhaps the most extensive, containing somewhere about 50,000 specimens. The Transvaal Museum has also rich material waiting for future study. The S. African Museum has a very representative collection, especially of the earliest described species of the Cape. In the other Museums moths are rather poorly represented, both as regards quality and quantity, and it is very necessary that these institutions should be given more facilities to obtain first-class representative collections. Several admirable private collections exist in which moths are well represented, but the lack of a reliable monograph seriously hampers their study by the workers they belong to.

A few words as regards the life-histories of the Heterocera may not be out of place. The larvae of less than one per centum of the species are known, and still fewer have had any scientific study. A few years ago Mr. C. B. Hardenberg took up the study of lepidopterous larvæ, and one trusts he will soon find more leisure to devote to this most important matter.

In connection with the scientific study of life-histories of larvæ, several members of the Agricultural Department should be mentioned, and also Mr. E. E. Platt, who has done a large amount of caterpillar breeding, not so much for specimens as for information.

The *Hymenoptera* (bees, ants, wasps). Although the *Hymenoptera* demand as full a treatment as that given for the Lepidoptera, I will deal with it but briefly. Perhaps no order of insects is so full of interest as is this, but it requires a Hymenopterist to deal adequately with the order. I will, therefore, mention but the names of some of those S. African entomologists who have particularly interested themselves in S. African bees, wasps and ants. The best known amongst these is certainly Dr. H. Brauns. P. Cameron also described several S. African wasps and Dr. L. Peringuèy worked at the *Mutillidae.* Recently Dr. Arnold, of the Bulawayo Museum, published a monograph on the *Formicidae.* Very little has as yet been done with the very small wasps like the *Chalcididae, Proctotrupidae, Ichneumonidae* and *Braconidae*, and they await a young worker full of energy. As regards collections of this order, apart from the private collections of Dr. Brauns and Dr. Arnold, those of the S. African Museum, Transvaal Museum and the Southern Rhodesia Museum are the only ones worth mentioning.

Having given me your kind attention for so long a time, I hope, ladies and gentlemen, you have not come to the conclusion that the study of insects in this country is being fairly well attended to. If so, you must have lost sight of the fact that I have endeavoured to deal with a group of animals comprising more than half the number known to exist. When this is borne in mind, when it is remembered that hardly a monograph exists on even the most important groups, that it is expected, in the Museums, that all this wealth of forms can be dealt with by one person, whilst most other animal groups have their specialists, even when these groups are often smaller in number than some of the moderately sized *families* of insects; when we further reflect that no other animals affect to such an extent our economic life as insects do, then I will not be contradicted when I say, that we are just on the fringe of this study, that we do not yet even know its boundary lines, far less the vast riches of its interior. Even if the number of our present workers was a hundred times more than at present, each would find more work than could be finished in a lifetime.

With these facts in mind, and realizing that it may soon be too late to discover and study some of the most interesting forms of life, owing to the rapidly changing floral aspect of the country, I say it is indeed necessary to devote more time and money to the study of entomology, that the whole problem should be attacked in a scientific manner both as regards the organization of entomological research and the granting of more facilities for this study by the Government, before it is too late. When we realize what other countries have done in this connection, we have very little reason to be proud or even content with our own share. A country with a small white population like India has a series of monographs on insects which will take us a long time to imitate. I believe the advanced condition in India is largely due to the stimulus given by the Bombay Natural History Society, and I sincerely hope that our Society will at some future time have a similar effect on the study of the insect fauna of South Africa.

In conclusion, I have to thank you for the honour you did me in making me your President for the past year, and I much regret that my limited leisure has prevented me from doing as much for our Society as has been my wish to do. I fully appreciate the kind assistance given me by the members, and especially by the Council during that year.—(*A. J. T. Janse.*)

A Criticism of the Foundations upon which the Theory of Mimicry is Built.

By C. N. Barker, F.E.S.

The theory of Mimicry by natural selection has been endorsed by a large and influential body of opinion, but there are many stumbling blocks which require elimination before it can be generally accepted as a feasible hypothesis. The exponents of the theory have relied almost exclusively upon insects, especially butterflies, for examples to illustrate their views. It has not been entirely neglected in its relations to the vertebrates, but the field for enquiry is a limited one, compared with that afforded by the vast congeries of organisms that go to make up the insect world. Before dealing with my own doubts as to the reliability of some of the premises upon which the theory of mimicry rests, I wish to draw attention to what that Prince of Sportsmen and very competent field-naturalist, the late lamented Capt. F. C. Selous, D.S.O., has to say on this subject in his book entitled "African Nature Notes and Reminiscences" (1908). His two opening chapters are devoted to some pertinent criticisms on protective coloration, recognition marks and the influence of environment on living organisms. His unrivalled personal experience of the habits of the fauna of South Africa, and in a lesser degree of that of other countries, lends weight to the criticisms he brings to bear on these subjects, and they are well worth the careful reading of all biological students. Mr. Theo. Roosevelt, at that time President of the United States, aptly says in his appreciative Foreword to the book, "Mr. Selous, by his observations, illustrates the great desirability of having the views of the Closet Naturalist tested by competent Field Observers."

Mr. Selous shows what some biologists claim to be protective coloration, as occurs in such conspicuously patterned animals as the zebra and giraffe, for instance, de facto is not protective under the usual conditions of their environments; and, further, that as the carnivora hunt almost exclusively at night and by *scent*, the coloration, be it what it may, is of little account.

The brothers Thayer, American artists and authors, in a work entitled "Concealing Coloration in the Animal Kingdom," give many expensive plates to illustrate how conspicuous colours and patterns lend themselves to concealment under certain environmental conditions, which, however, are evidently not always natural conditions!

For the same reasons, Capt. Selous doubts the efficacy, for protective purposes, of the snowy garb of most of the arctic animals, or the assimilative colours of desert animals. He considers that these assimilative colours must be due to the influence (physical) of their environment, and that natural selection has no say in the matter. Mutual recognition marks are equally condemned, and, I think, quite rightly, for the senses other than those of sight are quite ignored. However, as regards the cryptic coloration of desert and arctic animals, Capt. Selous overlooks the possible constitutional benefits that may accrue to them by their coloration, which may make these cases accountable to natural selection.

I cannot recall a single example among the insects, at any rate, in which purely pro-cryptic disguise may not be of service either for protection, aggression or both, provided it is conceded that the faculties employed are those of visibility alone. There are, however, innumerable cases of resemblance between organisms to which I can assign no use, so far as my knowledge goes, and among the most remarkable that I can recall, is the marvellous simulation of a small grass-snail by the bag-worm larva of a Psychid moth, *Apterona* species. Dr. D. Sharp, in "Cambridge Natural History—Insects," Part II, page 394, refers to it as follows:—"The most extraordinary are some of the genus *Apterona*, which perfectly resemble the shells of Molluscs such as snails; indeed the specimens in the British Museum were sent there as shells. This case is not, like those of other Psychidæ, constructed of earth or vegetable matter, but is of silk and is in texture and appearance exactly like the surface of a shell. *Psyche helix* is, according to Ingenutzky, found in great numbers near Lake Issyk-Kul in Central Asia, where the larvæ feed, in their snail-shell-like cases, on grass just like snails." Few organisms are more preyed upon than snails, so I quite fail to see of what benefit to the Psychid this wonderful mimicry can be. Some parasitic bees resemble their hosts, and it might be inferred that the likeness is to cover their intrusions, but, unfortunately for this hypothesis, there are many other inquilines that do not in the least resemble their hosts, and are by no means incommoded on that account. Some Asilidæ mimic bees and wasps upon which they prey, some spiders simulate ants; mantispas (Neuropterons) copy mantids (Orthopterons). In the case of all these, close association or similarity of habits appears to directly influence their superficial and even structural characteristics, whether due to psychological or physiological causes, or both, I do not feel competent to determine; but there are no obvious reasons for these resemblances being accounted as the results of natural selection. The analogous phenomena occuring between termites and ants, particularly in those extraordinary castes called soldiers, which belong to groups zoologically so far apart, is another instance in nature of like habits producing like results. Sharp infers that these analogies "probably (point) to some similar physiological susceptibilities in the ancestors, at an extremely remote epoch, of both groups." "Cambridge Natural History—Insects," Part I, page 503. The larvæ of insects of many distinct orders are remarkably similar according to their modes of life; thus the larvæ of Saw-flies (Tenthredinidæ) that bore in hard wood of trees are similar in appearance to coleopterous larvæ of similar habits, whilst those that feed on leaves resemble lepidopterous larvæ that do likewise.

One of the weak points in the mimicry theory is that it depends almost exclusively on vision for its elucidation, and it further relies upon the sight of the lower animals being of the same nature and capacity as that of the human eye. Next to nothing is known of the capacity and comprehensiveness of the faceted eyes of insects, and the sight of birds, although it doubtless varies much *inter se*, is probably far keener and possibly less discriminating than that of the human. The far ranging eye of the vulture is a good illustration of this point. Sight among insects and among the lower orders of animals generally is doubtless very subsidiary to their other sense organs, the natures of some of which it is impossible for us correctly to define.

Since writing the above it has been my good fortune to come across and read an excellent essay on "Animal Sense Perceptions" by Mr. W. L. Distant contained in "The Zoologist" of September, 1901. The subject is treated fully and in the usual thorough style which one expects from his ripe experience. I give the following excerpts to show how he views the question (page 323):

> "The importance of a clear comprehension of animal sense cognitions when a theory like that of mimicry is propounded must be obvious. Take, for instance, a bird or protectively coloured caterpillar, such as it appears to our cognitions. Should the power of vision in the bird be in excess of that possessed by ourselves, the resemblance may be only superficial and powerless; should it be less, then the protection may be excessive—an idea almost unthinkable in the light of the doctrine of natural selection."
>
> "We may see what appears to be, and may be, wonderful assimilative colouration or mimicking disguises, but the creature so protected, as it appears to us, may be readily detected by a keenness of scent in its enemies, of which we know little, or by a power of hearing, of which we know less."

Page 323:

"Do we not therefore go far beyond the scientific use of the imagination, when, as in the practice now so much in vogue, we not only conclude that every well established colour and marking, if not advantageous, is certainly not disadvantageous in the struggle for existence, but add the further postulate that they are so by reason that animal vision appreciates them in the same manner as is understood by ourselves."

Monsieur Fabre's experiments with some of the moths, notably that of the Notodontid *Stauropus fagi,* L. are worth citing. This species is almost unknown to occur so far south as Provence, where M. Fabre resided. However, he became possessed of an avid female, which he kept in a closed box inside the house, and he was able to watch the arrival of great numbers of males which all came from the north on the Mistral that was then blowing. No sense that we are cognisant of can account for the arrival of these males from a great distance away and with the wind. The homing instinct of the Chalicodoma bee is another illustration and equally inexplicable. With the hyper-sensitiveness of such organs as these, mere superficial resemblances are not likely to be deceptive to insects, so "Mimicry" must fall back upon birds and such lower vertebrates as depend exclusively on sight for its verification. Butterflies are the order of insects that are most used to illustrate the theory, and the depredations of birds are relied upon to prove its truth.

The fact that among some species of butterflies which more or less resemble one another there are groups that include both so-called distasteful and palatable species has led up to the Müllerian hypothesis of "Warning Colours." Birds hunt by sight, and more often than not capture their prey on the wing. It is therefore claimed that the acquirement of certain distinctive colours and patterns by several species of butterflies, among which are included some that possess distasteful properties, affords to all a measure of protection against the attacks of young and inexperienced birds which soon recognise them as a group to be left alone.

As I have tried to show above, and as actual evidence has proved, distastefulness with its accompaniment of warning colours, can only be claimed as affording a measure of protection to butterflies against the attacks of birds. Therefore if the warning colour hypothesis is to hold good, it must be proved that the depredations of birds are sufficiently severe to influence the trend of evolution. There is ample evidence to prove that some insectivorous birds, at least occasionally, prey upon butterflies (the order which has been most quoted in support of mimicry), but have we sufficient evidence to show that the losses sustained by these attacks are of such severity as to determine the direction of variation? Dr. D. Sharp, in "Cambridge Natural History—Insects," Part II, page 345, has the following:—"It is possible that the odour and taste (of the Danaides) are of some value to the insects; as, however, butterflies of any kind appear to be but rarely attacked by birds, and as their chief enemies are parasitic insects which attack the larval instar, it is impossible to consider this protection of the prime importance to the species as many theorists assume it to be."

Monsieur H. Fabre, Capt. Selous and many other field naturalists, myself included, have not observed a single case in which a bird has flown at and captured a butterfly.

I must add that I have on numerous occasions observed birds of many species, including bulbuls, flycatchers, and other insectivorous feeders, flitting about in close proximity to butterflies flying past, or hovering over flowers, and they appeared not to take the slightest notice of them.

Some others have been more fortunate, but the confirmatory evidence is so meagre as not to justify more than the statement that birds occasionally prey upon butterflies. The butterfly is a difficult prize for a bird to capture and with its small body and large wings a poor reward, when there are so many other insects, near to hand, which afford a much easier prey and a larger recompense. I have no hesitation in saying that for every butterfly (in Natal) destroyed by birds hundreds fall victims to other enemies in the imago, to say nothing of the still greater losses in the larval state. It is difficult to believe that natural selection can be so one-sided in its action, as to perfect the insect against one (the lesser) evil, whilst making no special provision for its safety against other and greater evils.

In predacious insects and their prey, by Prof. E. B. Poulton, Trans. Ent. Soc. 1907, page 327, he has the following:—

> "It seemed probable that the lessened exposure to vertebrate enemies would be largely compensated for by a relatively increased exposure to predacious invertebrata and especially insects. And this conviction has been confirmed even more fully than would have been anticipated from the limited extent of recorded material. Thus it will be found from African records alone that the widely mimicked *L. crysippus* has been devoured by an Asilid fly, a large Dragonfly and a Locustid; while another species of Locustid and a large wasp have been found eating the larva. Attacks by predacious insects upon the specially defended groups of coleoptera and upon stinging hymenoptera are also proportionately numerous."

It is generally claimed that conspicuous colours are an index to the distastefulness of a species, in reference to their enemies the birds. With "warning colours" is generally associated less alertness and a more sluggish flight, and this is claimed as an additional proof of their immunity. These qualities of conspicuousness and sluggishness naturally make them easier victims, for the great majority of insects and other enemies that prey upon them. Therefore what is claimed to be gained as against birds is lost in a far greater measure by the increased facilities given to predacious insects and to some reptiles and mammals that prey upon them.

Are these the lines natural selection works on for the perpetuation of species?

In the valuable and instructive article entitled "Bionomics of S. African Insects," the joint work of Prof. E. B. Poulton and Dr. G. A. K. Marshall, Trans. Ent. Soc., 1902, Prof. Poulton, in his introductory remarks, says (page 295), "the direct and indirect evidence of the attacks of birds on butterflies meets objections which are often raised, and indeed nearly the whole of this part of the paper is an effective reply to those who ask for facts, not hypotheses."

Now, taking the evidence as given in the Statistical Tables A and B, pages 349-352, of the contents of the insectivorous birds' stomachs, which is certainly the most reliable, and leaving out those experiments of feeding captive birds and animals, which are not in the same category, let us see how far they bear out Prof. Poulton's contention that they meet the objections which are often raised. Table A. The stomachs of 19 birds of 18 different genera; only one species, "*Merops natalensis,*" shows lepidoptera (two moths, not butterflies) as the dietary, and both these moths, *Pseudaphelia apollinaris* and *Cirina similis,* are "conspicuous, slow, day-flying, and probably distasteful species."

Table B gives the contents of the crops of birds of 40 distinct and named species; including *Caprimulgus rufigena, Falco subbuteo* in large numbers; *Rhinopomastus cyanomelas* and all the bee-eaters, *Oriolus larvatus* and all the cuckoos. Not a single species in the whole of this Table shows remains of lepidoptera in the stomach. In Table A *Coracias olivaceiceps* had eaten "a large evil-smelling, bright green locust (*Phymateus morbillosus,* L.), further described as having purple and crimson wings; very conspicuous with red thorax and head: legs red and yellow."

Merops natalensis had made a meal of "the characteristic cantharid, *Mylabris oculator*, Thunb., considered as among the most distasteful and highly protected of insects. Other insects found in the stomachs of birds of Table A include the following—a black *Syagrus* and *Macrocoma aureovillosa* (Eumolpinæ); *Psiloptera chalcophoroides* Pér.; *Sphenoptera disjuncta* and *Anthaxia sp.* (Buprestidæ); several metallic onthophagi and *Onitis alexis* (Coprinæ); *Anthia pachyoma*, *Polyhirma semisuturata*, *Piezia marshalli* and *Scarites* sp. (Carabidæ). Of those enumerated above none can lay claim to being procryptic, and most of them are decidedly conspicuous beetles. *Merops natalensis* appears to be the least fastidious of all these birds, as the stomachs of the two examined contained the two distasteful moths as well as *Mylabris oculator*.

The stomachs of birds included in Table B provided several stinking Pentatomid bugs (probably cryptic); conspicuous Reduviid bugs; *Onthophagus gazella*, *Aspidomorpha punctata*, *Polycleis decora*, all non-cryptic insects; scorpions, centipedes, hairy caterpillars and stinging Aculeates. All these are insects which might claim to be included in the partially protected class either on account of taste or other defensive qualities.

As against the complete absence of butterfly remains in the stomachs of birds in Tables A and B, there are two records given by Dr. Marshall:—

> December 15th, 1898. Remains of *Papilio demodocus* found in the stomach of a cuckoo (*Coccystes caffer*), and January 1st, 1899, Swynnerton shot a hobby (*Falco subbuteo*) which had in its stomach an almost complete *Terias*.

Between March 28th, 1897, and December 17th, 1901, Dr. Marshall, in collaboration with Mr. Swynnerton, both keen observers, who were utilizing much of their time in looking for evidence of birds attacking butterflies, record 7 cases of actual capture, 2 of which (moths) were rejected; and 3 of futile attempts to capture. Colonel Yerbury's Records—pages 359-360—"As the result of a discussion which arose in the Bombay papers about the year 1884 as to whether birds preyed on butterflies, the general opinion expressed was that it was comparatively rare for them to do so. In common with some other members of the Bombay Natural History Society, I determined to watch and record results"—1884 none. 1885 one attempt not repeated. 1886 one capture. 1887 none. 1890 no record. 1891, November 14th, on the Kandy road between Trinkomali and Kanthalai; butterflies in great numbers sitting on the wet mud by the road side; chiefly Pierinæ (Cataphaga), but a few *P. nomius* with them. These butterflies rose in clouds as one drove past. A bee-eater, *Merops philippinus*, kept flying in front of my carriage and taking specimens of these butterflies as they rose." . . . . He adds, "these bee-eaters were often seen catching Pierinæ; in fact, it seems to have occurred so often that I ceased to record the fact, for I can only find this one reference.

"Probably the attacks were always witnessed at the beginning of the N.E. monsoons during the time of the heavy rains, September to December." He also refers to an incident of an ashy swallow shrike (*Artannus fuscus*) which he saw catching *Crastia core*, but he could not see whether they were eaten. *Crastia core* is a Danaid credited with most distasteful properties.

Colonel Bingham's notes "of attacks on butterflies by wild Burmese birds" adds some important data. It principally relates to the hawking of mobs of butterflies and insects brought together by some attractive bait, which afforded the birds specially favourable conditions for capturing them. Naturally the birds would recognize their opportunity and take full advantage of it. Colonel Yerbury's experience on the Kandy road, given above, is of an exactly similar nature. The most wary butterflies, such as our South African Charaxes, when feeding on an exudation of sap or gum of some favourite tree, can be readily approached and even caught with the fingers. The flowers of the Poinsettia, a shrub non-indigenous to S. Africa, is nevertheless extraordinarily attractive to many of our butterflies, bees, wasps and other insects. *Iolaus silas* and *I. sidus*, under ordinary conditions wary insects, when feeding on this flower, can be taken with the utmost ease. The pure white undersides of these butterflies, contrasted with the bright red bracts of the Poinsettia, make them extremely conspicuous, yet these and other butterflies appear to be quite oblivious of danger.

Of all the records given in "Bionomics of S. African Insects" the most important in favour of systematic persecution is that afforded by the numerous butterfly wings found in the nests of the Falconets *Microhierax caerulescens*, L., and *M. fringillarius*, Drap., as recorded by Colonel Bingham, page 363, but taken as a whole the records afford, to my mind, very meagre evidence on which to claim that butterflies have been driven to adopt superficial disguises and other qualifications against the attacks of birds, which are of little or no use in protecting them against their many other and far more numerous persecutors. In the whole of my 30 odd years of field work, I have never seen a butterfly captured by a bird, but I do remember on one occasion seeing a Paradise fly-catcher, *Terpsiphone perspicillata*, swoop at a red butterfly, either *Danaida crysippus* or *Hypolimnas misippus* (female), which the butterfly easily evaded. It struck me at the time that the action of the bird was more sportive than in real earnest. Colonel Yerbury mentions the occurrence, referred to above, of the Cingalese Ashy shrike hawking *Crastia core* and carrying its captures up into a tree, where he (Colonel Yerbury) was unable to see whether they were eaten. Our Natal black and white Fiscal Shrike, *Lanius collaris*, often seizes the common and reputed very distasteful Cantharid, *Mylabris alternans*, Cast., which it impales alive on thorns, apparently out of pure sport, as the remains are met with in all stages of decomposition. Possibly the capture of *Crastia core* by the Ashy Shrike is an analogous occurrence.* Another fact which impresses itself on one is that relatively to the numbers of so-called protected and non-protected species, the records show as many attacks on the one as on the other. Before leaving this part of my subject, the most important of all if the mimicry theory is to hold good, I must refer to the opinions of another very experienced field naturalist, Monsieur William Schaus, who spent many long years in the study and collection of insects in Mexico, Central America, Guiana, Brazil and the Antilles, as expressed in his paper, 'A quoi sert le mimetisme," read at the le Congrés International d'Entomologie, Bruxelles, 1911, page 296· "Parmi tous les arguments avancés par ceux qui admettent le mimetisme, on attache de l'importance à la destruction des papillons par les oiseaux, mais quiconque a vécu quelque temps dans un forêt tropical saura que cette destruction est un mythe. Les papillons rhopalocères, ceux qui volent le jour, sont parmi les aliments les moins attroyant pour les oiseaux, et, s'il n'en étais pas ainsi, un grand nombre d'espèces auraient été exterminés depuis longtemps. C'est un cas très exceptionnel que de voir un oiseau se lancer sur un papillon, et s'il le fait, il le manque neuf fois sur dix. N'importe quel chasseur d'insectes vous dira comment un petit insecte peut souvent éviter un grand filet, et un papillon n'a qu'a se poser pour éviter la poursuite des oiseaux qui ne l'attaquent qu'au vol. Une seule fois j'ai vu des oiseaux poursuivre a plusieurs reprises des papillons: c'etait a Sachi, au Costa Rica, où des *Enmornota superciliaris* s'elançaient sur des *Heliconius petiveranus*, une des espèces soidisant protegées par un mauvais goût. Je n'ai jamais vu un oiseau essayer d'enlever un papillon au repos; mes remarques s'appliquent au papillons diurnes; il faudrait des mouvements bien dissimulés pour réussir, de ce sort les oiseaux sont incapables, les sauts, les mouvements des ailes et de la tête effrayant un papillon, qui est toujour sur le qui-vive et effarouché par tout objet étranger."

*Since this was written I have read the testimoney of Mr. Freyer (in the Proc. Zoo. Soc., 1913), which shows that this bird preys largely on butterflies of the slow-flying distasteful groups, Enpleinœ and Danainœ.

I have quoted the paragraph in full, as his experiences from the Neotropical regions are completely in accord with my own limited experiences in this sub-region. It is also worthy of note that on the only occasion where he saw a bird fly at a butterfly the butterfly was of the supposed distasteful genus, *Heliconius*. Distastefulness is evidently a very qualified protection judging by the number of species among insectivorous birds which totally disregard it. Monsieur Schaus concludes his paper by stating that he has conversed with many collectors of birds and insects, who all agree that the captures of butterflies by birds are quite exceptional cases.

By kind permission of the Rev. Father J. A. O'Neil, S.J., with whom I have had the pleasure of corresponding on entomological subjects for many years, and whose first-hand knowledge of South African insects is as thorough as his opinions are valuable, I quote from a recent letter dated Salisbury, Rhodesia, 30th June, 1917:

"I have only once noticed a bird chasing a butterfly (*B. mesentina,* as far as I could see), and the fly escaped. Like you, I am very sceptical about the advantage of the so-called "protective mimicry" of certain insects; and I doubt very much if their resemblance to distasteful or otherwise protected insects does help them. Take, for instance, the wonderful *Mutilla* mimics (Cerambycidæ, Cleridæ, etc.) which we have in this country. Some of them, such as a local *Caloclytus* (near to *krantzi*), and a large Clerid, are so exceedingly like a *Mutilla* that at first I mistook them for such. Now, if this mimicry protected them from enemies, one would expect them to be commoner than their near congeners, yet they seem to be extremely rare. Of the *Caloclytus*, I have only seen a single example in 4½ years. Our wonderful large Sphegoid and Brachonoid Cerambycinæ, found in Matebeleland, are equally scarce. I met only one example of each in 7 years. No doubt Prof. Poulton and his school of thought would maintain that but for the protective mimicry they would have become extinct; but this would be a perfectly gratuitous assertion.

Further, supposing a bird, mantis, or other enemy were to notice one of these unprotected mimics, the chances are ten to one that such foe would have had no previous experience of the protected form. Even if it had had such experience, it would seize the mimic. This I am convinced of from my own observation, for time after time I have offered mantides or chameleons, insects (such as aculeate hymenoptera, nauseous Pentatomidæ, Coccinellidæ, etc.). which were certainly very much protected; yet they were seized at once on nearly every occasion, and in some cases the hymenoptera were devoured. Those who believe and maintain that resemblance to protected forms is also of service to unprotected insects would doubtless assert that our large black Asilid is protected from Mantides by its wonderful resemblance to a Sphex. I don't for a moment believe that it is. Only the other day I offered a large green mantis, that I have been keeping for many weeks, a big black female Eumenid wasp, and at the same time I placed in the jar four butterflies—two Acraeas, one *C. florella* and one *J. clelia.* The wasp was seized first, and totally devoured except for one wing; the two Acraeas (*caldarent* and *nohara-halali*) went next, and the other two butterflies were left untouched, though I kept them in the jar for some days without offering the mantis any other food."

In response to my enquiry asking for instances of birds preying on butterflies, Mr. Harold Millar, Curator of the Durban Zoological Gardens, has kindly provided me with the following personal observations. Mr. Millar has from his boyhood (for some 40 years) been an assiduous collector and keen observer of both birds and insects.

"In November 1915, when collecting at Pigeon Valley, Berea. I came across large numbers of *Lacnoptera ayresii*, most of them newly hatched and some of them only just able to fly. I was busy for about two hours catching specimens and during that time, on one accasion I observed a S.A.P.F. (*Terpsïphone perspicillata*) dart past me, at about 15 feet distant, and capture a *L. ayresii* which it devoured. Among the specimens I netted, there were several which had the wings chipped symetrically, on either side, suggesting that the butterflies had been attacked when resting with the wings closed; some others showed chips on one wing only, as if they had been seized when in flight.

A few days later, at the same spot, looking for more specimens of *L. ayresii,* I saw a Natal Kingfisher *Ispidina natalensis* capture and devour a freshly emerged specimen. I only saw this occur once."

Mr. Millar also records a further interesting occurrence:— "In October, 1892, I shot 2 pigeons, *Turturaena delegorguei* on the Clairmont Estate near Durban. On picking them up off the ground by the legs, a quantity of young froghoppers (immature Cercopidae probably *Ptyelus grossus*, F.) were disgorged from the crops, together with the spittle that envelopes them." He concludes his letter as follows:—"You have asked me, have I frequently seen birds catching butterflies? My emphatic answer is NO! I am of opinion that butterflies as a food are not looked to in particular. That is in reference to butterflies in full strength and vigour. Young just emerged flies of most varieties would, I think, be taken by nearly every kind of insectivorous bird. But generally speaking, I consider that the butterfly is not a special or *general* food of birds."

In a very interesting presidential address to the Entomological Society, 1904, Prof. E. B. Poulton takes as his subject "Are acquired characters hereditary?" A considerable part of the paper is taken up in defining the difference between *acquired characters*—(in the scientific sense) as distinguished from *inherent characters.* The Professor quotes Lloyd Morgan's definition in "Animal Behaviour," 1900, page 120:—"Instinct depends upon how the nervous system is built through heredity; while intelligence depends upon how the nervous system is developed through use." Prof. Poulton gives as his own brief and convenient definition of acquired characters "as those modifications of bodily structure or habit which are impressed on the organism in the course of individual life," and hereditary "those characters and properties with which the individual is originally endowed."

On page CXVIII, referring to insect life and habits, Prof. Poulton shows and affirms that heredity is alone responsible. "The behaviour which leads to the production of an elaborate cocoon or the burial of a larva in its earthen cell is *clearly instinctive*, and the most convincing evidence would be required (evidence which it is needless to say is entirely lacking) in order to prove that certain insects which perform an act no more elaborate many times in their lives are guided by anything except the compulsion of a "nervous system built through heredity."

"If the cocoon-making instinct has evolved through selection, the comb-making habit of the social hymenoptera has surely arisen in the same way and *not through the operation of an entirely different set of causes.*"

After having ennunciated so clearly and convincingly the claims of instinct to account for the wonderful organization of social hymenoptera, the elaborate cocoons of moths, etc., it does seem a bold flight which denies all instinct to the birds which, we are assured, must acquire by experience what is good and what is bad to eat.

Is it instinct or is it acquired intelligence that has taught the weaver birds to build their pendant nests? If it is due to intelligence acquired during life time, how is it that the inexperience of young couples does not lead them astray in this important function? If it is intelligence that is relied on, how is it that swallows so often build their mud nests in unsuitable positions such as under iron roofs, with the result that they fall down, and yet are often rebuilt under identically similar conditions? If it be instinct, as I should suppose, that teaches them to build, it would naturally fail to teach them the inappropriateness of building under iron roofing. The inexperience of young birds in the matter of food, if such does occur, though I think there is not much evidence to prove it, one would expect to be corrected by the parents who are with their nestlings for some time after they leave the nests. It seems difficult to believe that instinct is lost among the lower vertebrates in favour of such a very limited intelligence.

My aim in writing this paper is, as the title demonstrates, to voice my doubts as to the correctness of the assumptions on which the theory of "Mimicry" relies to prove its reality in nature. In adding a few remarks upon possible causes and effects, I am fully aware of my deficiencies and of my inability to treat so thorny and intricate a subject with any credit to myself or illumination to my readers. With this apology for my shortcomings, I am content to venture my opinions and leave them to be taken for what they may be worth.

Evolutionists of nearly all denominations agree that variation acts by slow degrees; by slight modifications here and there in details of an organism. The initial stages that may eventually bring about the mimicry of one organism by another, or the cryptic semblance of immediate surroundings, must originally be of the vaguest character; quite insufficient to produce in itself any benefit in the shape of disguise for either protection or agression.

Primitive attempts at development in any given direction must have had, therefore, some incentive, which can only be heredity stimulated by environment. In the beginning there is no appreciable differentiation towards "Mimicral" results upon which natural selection can act by elimination. Now, if it be granted that the beginnings of a variation are the outcome of constitutional and environmental causes, is there any reason why the development should not maintain its tendency in a certain direction towards its objective, so long as the physical conditions remain constant, independently of the action of natural selection? Doubtless, when the variation has advanced so far as to demonstrate its utility, the action of natural selection might be of use in expediting the process by the elimination of those that showed a disposition to reversion or to stagnation. The doctrine of natural selection assumes that no variation can maintain itself unless it serves a useful purpose in the struggle for existence.

Sexual selection suggests the acquirement of adornments for the purpose of display by the male sex in order to attract the other sex. It, therefore, only benefits the individual in rivalry with others of his kind, and more often than not, from the nature and even monstrosity of the developments, it must handicap rather than aid him in his usual avocations. Under Sexual Selection are included such strange and bizarre devices as the clypeal and thoracic horns of some Lamellicorn beetles; the monstrous developments of the posterior legs of Hoplinæ and Sagrinæ, the tails of some Lepidoptera and a thousand and one other examples that might be cited among insects, in which abnormal appendages occur, to which no beneficial use can be assigned other than that of adornment. Among the vertebrates and other orders numerous examples occur of a similar nature.

In addition to those cases which can be attributed to sexual selection, there are many others in which abnormalities are common to both sexes, and which certainly cannot be accounted for under that of Natural Selection. As examples:—The Craneflies (Tipulidæ), with inordinately long weakly-jointed legs; Membracidæ (sub-family Centrotinæ), with extraordinary thoracic appendages; the genus *Mormolyce* (Carabidæ), from the East Indian islands, long-tailed Lepidoptera, such as *Dianeura* sp., of East and North-East Africa, the hind wings of which have been modified into caudal processes or balances, and which, by the way, are strongly analogous to similar appendages borne by the Nemopterinæ (Neuroptera). From what I have written above it will be inferred that I am strongly inclined to doubt whether natural selection has more than a very subsidiary role in the production of the numerous cases of resemblance that occur in nature. The disposition to vary among organisms in favour of display is to my mind a very real factor; and that the male sex is the more susceptible to these influences gives one good reason to assume that the incentive is primarily sexual; that the male development is often followed on by the female, which in some cases have caught up with the male and in still rarer cases even passed him.

It is for these reasons principally that I believe the females of *Papilio dardanus-cenea* and of *Hypolymnas misippus* are the more ancestral. The beauty of the butterfly's wing is largely governed by the desire for display, and the distinctiveness of certain types in certain faunistic areas may be the result of climate acting on susceptibilities responsive to the same stimuli, or, in other words, that are following the same lines of development. Variation must, in diverging from one type, converge on some other (for colours and patterns are limited), and in doing so resemblances must sometimes be produced. If from any cause the colour, pattern, or even contour, should prove beneficial to the insects, natural selection might maintain and even improve on the resemblance, but that does not imply that it is simply useful as a protective disguise (though it may be in some cases), but rather that it is constitutionally correct, as is the black skin of a negro to his environment. In the course of ages more and more cases would occur of butterflies developing on parallel or converging lines arriving at the same point, as we may assume Nos. 1 and 2 originally arrived at; *i.e.*, at that point where the physical conditions of their environment would directly act upon their constitutions to bring about similar results and add yet further examples of the types suggestive of the sub-region to which they belong.

In spite of these restraining influences, be they physical or due to natural selection, some butterflies impelled by their constitutional forces, will continue to vary, and this, more often than not, will be in the direction of further adornment or display, which may be due to sexual selection or to overwhelming hereditary impulse to change. Whichever may be the impelling force, there is no doubt that the males have generally taken the lead in these developments.

The constant migration of butterflies to and from a given region must cause great changes in the directive tendencies of variation, and this might account for the numerous examples of species of the same genera which exhibit developments in opposite directions such as occur for instance in *Pseudacraea trimenii*, Butler and *P. imitator*, Tr. Polymorphism, such as is met with among the females of *Papilio dardanus*, may be reversions due to instability brought about by the same causes (migration) acting on constitutions exceedingly susceptible to such influences.

The uniformity of coloration of desert animals I attribute to direct physical causes which react upon the constitutions. Incidentally, cases occur among birds and small mammals in which the assimilative coloring is of value to them as disguises against the attacks of predacious birds that hunt by sight. On the other hand, it seems likely that it is of no use to these and others against the attacks of carnivora that seek their prey by scent.

Much capital in favour of mimicry has been made out of the fact that the Planemas and Pseudacræas vary analogously according to the countries or districts they frequent. The same phenomenon occurs even more markedly in South America, where Bates has stated that "numerous series of gaily coloured butterflies and moths of very different families all change their hues and markings together, as if by the touch of an enchanter's wand at every hundred miles." Pro. Ent. Soc. Lond., 1879, page XXIX.

Is not this just as good evidence of the direct effects of similar climatic conditions, acting on various organisms susceptible to the same chemico-physical stimuli, as that it is the result of mimicry by natural selection? Some very instructive results might be obtained if systematic experiments were made, by transmitting the ova of species from one district and breeding from them in contiguous districts, under as natural conditions as possible, through many generations.

In October, 1916, I received from Mr. H. Barber a small collection of butterflies all taken during March of that year at Kampala in Uganda. Included among them are specimens of *Ergolis inotria,* Cr. (Nymphalinæ) and *Ypthima argentata,* Bartol (Satyrinæ). These two species of distinct sub-families are covered with a surface scaling of a whitish silvery colour which covers and obscures the sombre browns peculiar to their congeners. I think this can be safely claimed as a case of similar environmental results on two widely separated species brought about in the way I have sketched above.

The butterflies of the Celebes islands have acquired a similarity in the elongation of the forewings. Can this peculiarity be claimed as the result of mimicry? If so, what benefit do they derive from this abnormality which affects the whole community? *Philocnema latipes,* de Geer, and many other Callichromides vary from green to purple in the colour of their elytra according to the localities which they frequent; in Natal they are green on the coast belt and become purple in the upland districts.

Among the butterflies of South Africa there are several groups which come under the Mullerian formula of Mimetic Associations, which have been designated by Prof. Poulton as "Synaposematic" groups. The principal models for these groups are included among the Danainæ and the Acræinæ. Other large mimetic associations have been proposed, made up of insects of many denominations that have a common system of coloration, and in these groups are included insects of all shapes and sizes. Chief among these can be mentioned the Lycoid and Multilloid groups. As a colour group the Pieridæ are by far the most conspicuous and numerous, yet, somewhat unfortunately for the warning colour theory, they provide only one genus (Mylothris) to which can be attributed any distasteful properties, and in that case only in a minor degree. This discrepancy of so important a group is felt as a weak joint in the "Mimicry" armour, and has led up to assumptions of the partially protected characters of such genera as *Belenois* and *Terias*. Any field naturalist of experience and of unbiassed mind will, on the contrary, bear me out when I say there is no class of butterflies more preyed upon than species of these genera so far as predacious insects are concerned and the records from birds appear equally damaging to these assumptions. It is worth noting that during the dry season in Natal, and probably elsewhere, the whites are proportionately more numerous compared with butterflies of other colours than during the wet season. This is the season when one might expect the attacks by birds to be the most exacting.

Mr. Eltringham even makes a model of *Atella phalantha*, one of our most wary and least likely of insects, to figure in that role; and, further, figures *Mylothris trimenia* as model to *Phrissura lasta* (female). As the Mylothris is localized to parts of the Eastern Provinces of the Cape and a few districts of Natal, and *Phrissura lasta* is recorded from British East Africa, I fail to see what purpose the resemblance serves in the mimicry sense. There are several other examples given that have as little right to consideration in this respect.

In conclusion, to briefly summarize my views:—

I consider that the evidence in support of Mimicry by natural selection as a protective agency is quite insufficient, and often misleading, except, perhaps, in those cases that come under Procryptic disguises. In these cases protection is as much afforded by absolute immobility as by the nature of the disguise.

That in cases of analogy in which the methods and organization of non-related communities are of similar nature, I am inclined to think the instincts involved are partly due to psychological causes.

That variation is governed by heredity, and its direction influenced by physical causes such as those of habits and environment, and, finally, that the duty of natural selection is somewhat like that of the public hangman who executes those who do not conform to these rules of nature!

That nature as often achieves her purpose in the perpetuation of species by hardihood and prolificness as by any other specialized form of protection.

That nature is a huge scheme of compensation balances, some of the details of which we can only guess at.

Addendum.

Since writing my paper on "Mimicry by Natural Selection," it has been suggested to me that I have not referred to any of the more recent literature on the subject. Most of this was not available to me at the time, but through the kindness of a friend, I have since received a good deal of interesting matter on this absorbing subject. I have had the pleasure of reading the discussions raised by the publication of Professor Punnett's book on "Mimicry in Butterflies," and I have studied the book itself. The following are a few comments upon what I have read, and how they appeal to me as a free lance:—

The aggregate results still leave me far from satisfied, upon the one point, which I consider vital to the whole theory of "Mimicry by Natural Selection," for it is the very foundation upon which the whole superstructure rests. It is hardly necessary to say that I allude to the *discriminating* persecution of butterflies by birds. Mr. Swynnerton (Ibis, 1912) gives some further evidence in support of the attacks of birds on butterflies, but a great deal of his paper is devoted to the results of experiments in feeding captive birds, which, in my opinion, are unreliable tests as to the habits of wild birds. Per contra, there is much data from Col. Manders (Trans. Ent. Soc., Lond., 1911), Mr. Freyer (Proc. Zoo. Soc., 1913), and others, which is decidedly damaging, especially on that all-important point of discrimination. Prof. Punnett's comments on this and other evidence (page 113 "Mimicry in Butterflies") are very fairly put. The results from the examination of the contents of birds' stomachs can hardly afford much satisfaction to the upholders of the mimicry theory, and the data afforded by the results of the examination of 40,000 birds by the Department of Agriculture of the United States is most disastrous. Only four contained remains of Lepidoptera.

There is much in Professor Punnett's book with which I am in accord, but the discussions that have ensued on its publication have naturally afforded many opportunities for criticism, which have been taken the fullest advantage of by the other side, as might be expected when such Nestors in Biological science as Prof. Poulton and Dr. Dixey take the field.

The "mutation" theory, so far as I at present understand it, does not appeal to me as an efficient substitute for the simpler theory of mimicry by natural selection. It changes the method, but leaves the causation or incentives obscure.

Prof. Poulton, I think, has the best of the argument in favour of small variations leading up to the perfected image. The examples given in "The Hereditary Transmission of Small Variations and the Origin of Butterfly Mimicry" give many and good examples of the gradual evolution of the markings and patterns on the wings of Lepidoptera.

Many illustrations are also afforded by Prof. Poulton and others to demonstrate that small variations are transmissable from female parent to their offspring, but is this always so? Is it not dependent on the male being homozygous to the female to use the Mendelian expression. The character selected in one illustration, that of Dr. G. D. Hales Carpenter's paper, (Trans. Ent. Soc., Lond., 1913) on "the inheritance of small variations in the pattern of *P. dardanus*," is the shape and size of the white cellular spot of the forewing. It appears that this cellular spot varies in size amongst the different geographical races of *P. dardanus*. *P. dardanus,* as it occurs in Natal, differs as regards the size and shape of this spot enormously, and it (the spot) is sometimes altogether absent. Whatever may occur in the generality of cases of transmission, Prof. Poulton, on Plate I of his paper, "Mimicry, Mutation and Mendelism" (Bedrock, April, 1913), gives the photos of a female hippocoon and her offspring, in which the only example of this form differs materially as regards the cellular spot and other details from the parent. In the extremely interesting discussions as to how the two wonderful "mimetic" female forms of *Papilio polytes* were evolved, the explanation that claims that they were produced in all their wonderful mimetic details by a sudden "mutation" seems to me preposterous. The utmost I should feel inclined to agree to is what has been conceded by Prof. Poulton, "that a large variation may arise suddenly, no one ever doubted, but not many naturalists will accept the view that a complex pattern of many elements resembling the corresponding elements in an entirely different species could spring into existence as a whole and complete in all its details" (Bedrock, page 306).

I am quite unable to understand Prof. Poulton's explanation of the reason for the existence "of two mimetic forms in a butterfly that remains dominant, when the models are absent or excessively rare" (Bedrock, page 310). I have always clung to the formula that natural selection only acts in cases in which its action is for the betterment of conditions that make for the conservation of species. *Papilio polytes*, whether the models are absent or present, is equally well able to maintain its numbers unimpaired. The only reasonable inference, that I am able to understand, is that of Prof. Punnett that "natural selection is non-existent in so far as concerns the relation of the mimetic to the non-mimetic females of *Papilio polytes*" (Bedrock, page 158).

In all the discussions that have arisen in efforts to explain the causes which have produced the resemblances that occur in nature, and which are so often and wonderfully illustrated in the wing patterns of butterflies, psychology as a factor in their production appears to have no supporters. I cannot pretend to any scientific knowledge of this subject, but we are all aware of the influence of the mind over matter, especially during the time of pregnancy in women, when sometimes it produces unfortunate results in the offspring. I also remember reading, many years ago, a caution to breeders of fancy poultry against placing white fowls in breeding pens alongside coloured varieties, as it sometimes results in white feathers being produced in the progeny of the coloured stock—I think Tegetmeir, the great poultry fancier, was the authority for the assertion. Under Sexual Selection the incentive is display, and this is, in the case of butterflies, markedly developed in the beauty of the wing patterns. There are also cases in which abnormal developments are common to both sexes, to which it is impossible to suggest a meaning under either sexual or natural selection. Is it not within reason that some, at least, of the resemblances in the wing patterns of butterflies, whose affinities are far apart, may be the result of close daily association in the same environment? Is it not possible that the nerve centres, within the limits of their constitutional tendencies (colour and pattern factors in the case of butterflies), may be subject to reactions, which may bring about some of the mimicral results that are so frequent in nature? The incentives, of course, would be emulation to acquire an adornment already possessed by another species. Its perpetuation, other conditions being equal, would be the mutual preferences shown by the sexes to a new and pleasing pattern.

Whether there may be anything in my suggestion worthy of further enquiry or not, it is meant as an effort to broaden the scope of investigation into these intricate problems of nature, for nothing is so disheartening as the attempts to make square pegs fit into round holes.

An Interesting Group of Leaf Fungi.

By Ethel M. Doidge, M.A., D.Sc., F.L.S.

It is universally acknowledged that the flora of South Africa is an exceptionally interesting one and offers unique opportunities to those who make a study of plant life. There is no lack of nature students who are interested in flowering plants, which naturally recommend themselves as objects of study by their beauty or by their peculiarities of structure, and the systematic or economic botanist has no difficulty in getting into touch with enthusiastic collectors in different parts of the country. Up to the present, however, very few have turned their attention to the more minute forms of plant life, which are equally interesting and beautiful, and some of which are of as great importance as the more conspicuous flowering plants.

My object in writing this paper is to endeavour to arouse interest in a group of fungi which has occupied my attention for some years, and which is very richly represented in this country. The word "fungi" to most people immediately conjures up a vision of mushrooms and toadstools so-called—which are not easy to handle and form into a collection as many of them deliquesce at maturity, and all lose their form and colour on drying.—Or puff balls or the bracket fungi common on tree trunks, are called to mind, but these latter, although easy to collect and preserve, are not a very suitable group for the amateur collector unless he has unlimited space at his disposal; most of the specimens being bulky, and requiring constant fumigation to prevent their being destroyed by insects.

It is not of these large, fleshy forms I wish to write, but of a group of fungi which produces more or less definite black spots on leaves, and among which, although there is a monotonous sameness to the naked eye,

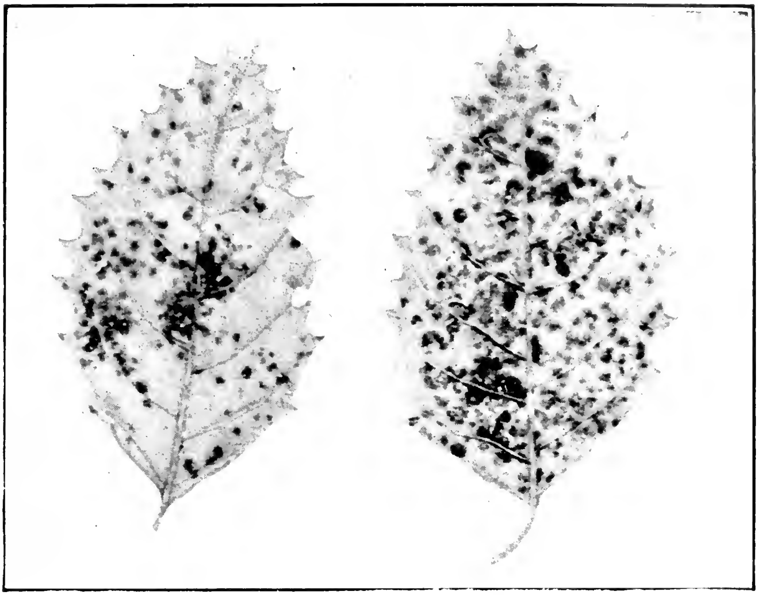


Fig. 1.

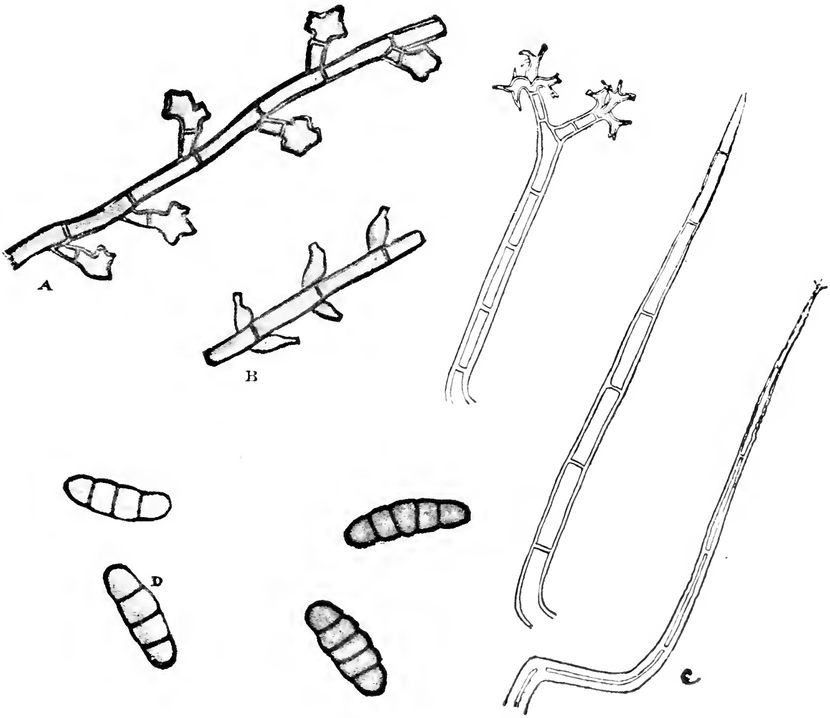


Fig. 2.

the microscope reveals the most varied and interesting forms.

Very little apparatus is necessary for the study of these plants, and they would provide a most interesting hobby for one who has access to a microscope. The *Perisporiaceae* and *Microthyriaceae*, the families I wish to discuss, are closely related to the powdery mildews which are only too well known to anyone who has a garden; the rose mildew and the mildew on vines being particularly common. They are also near relatives of the sooty moulds, such as the one forming a black scabby coating on orange trees which have been infested with scale or other insects. But the black spots we are in search of are not to be found, so far as I am aware, on cultivated plants; they are very common on native trees and shrubs, and on herbaceous plants growing in humid situations. The forests of the Knysna and the Zoutpansberg, the wooded kloofs of the coast districts all yield a rich harvest to the collector; the only part of the country where few or none have been found is the high veld, where the atmosphere is too dry to foster their growth.

How to Collect.

As I have already indicated, the forest or bush is likely to yield the largest number of speciments, and it will be found that these fungi are most numerous on the fringes of the bush, or where there is a small clearing in the forest. On the lower leaves of the trees and shrubs and on the herbaceous undergrowth there are numerous black spots which are quite superficial and as a rule can easily be scraped off the leaf with a penknife. Fig. 1 is a photograph of a very common species, *Meliola ganglifera,* on leaves of *Curtisea faginea*, the Assegai wood. These may be on either the upper or lower leaf surface, or less frequently on the leaf stalks and stems; they may have a velvety appearance, and when examined with the hand lens show a number of erect black hairs which are straight, curved or branched like a miniature forest; or the fungus may only form a thin black crust.

It is also possible with the hand lens to discover whether the fungus is in a suitable condition for study, *i.e.*, whether the reproductive bodies are present, bodies of as great importance to these minute plants as the flowers and fruit of the more conspicuous angiosperm. If the specimen under examination belongs to the *Perisporiaceae*, the reproductive bodies can be detected as very minute black spheres, or, if it is one of the family *Microthyriaceae*, as hemispherical or elongated bodies flattened against the leaf surface. These will be described later in greater detail. So far as my experience goes, mature fruiting bodies are usually present in the winter months, and the best specimens have been collected from May to August.

When the fungus has been detected, a sufficient quantity of the leaves bearing the black spots should be collected; at least two or three dozen leaves if they are available, so that there will be sufficient material for exchange should the fungus prove an especially interesting one. It is also necessary to collect a good specimen of the host-plant so that it can be identified: this should include fruit and flowers if they are obtainable.

The leaves can then be dried between newspapers under pressure, in exactly the same way as specimens of flowering plants, care being taken to number the specimens consecutively and to enter in a note-book details of the locality and date of the collection, leaving a blank for the names of the fungus and host if these are not known, thus:—

Collector's No.	Fungus	Host	Date	Locality	Collected by
1956	*Meliola capensis* (K. & Cke.) Th.	*Hippobromus alatus*	7/10/14	Kentani	A. Pegler

The example given is from the collection of Kentani fungi made by Miss Pegler, who has collected a large number of new and interesting species.

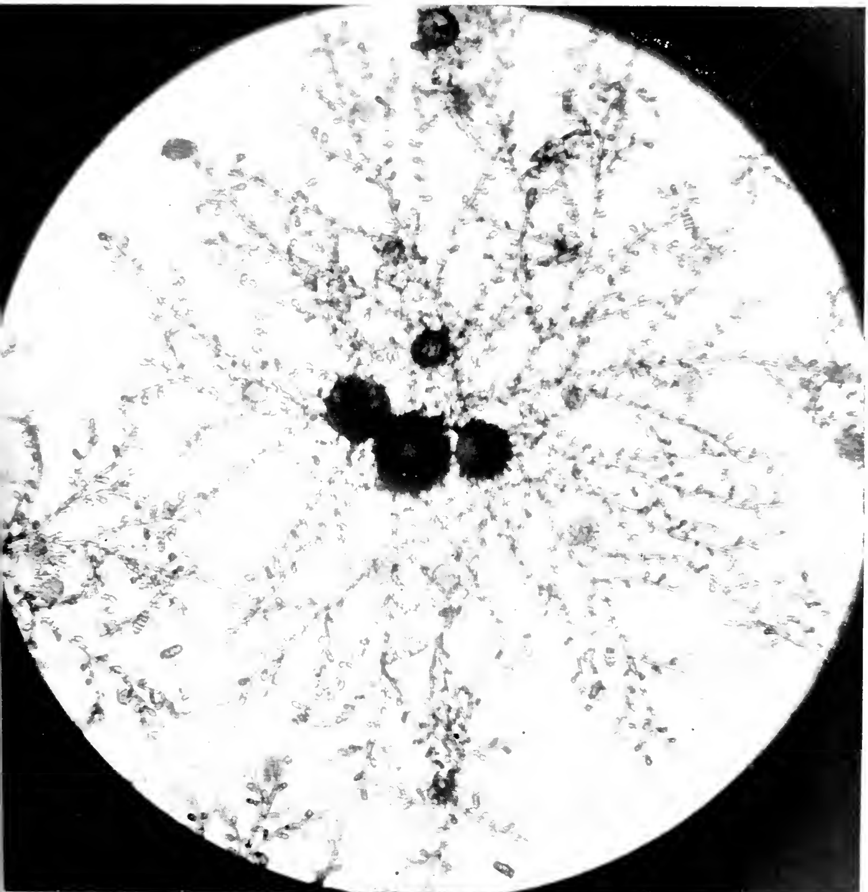


Fig. 3.

In the matter of naming the fungi I shall be pleased to be of any assistance to intending collectors, and to refer them to such descriptions of South African fungi as have been published up to date.

Microscopic Preparations.

A series of permanent microscopic preparations can very easily be made, and serves a two-fold purpose; the slides are handy for reference and comparison, and it is not necessary to prepare a fresh slide every time a specimen is examined; in this way also the specimens suffer less, as there is no need to destroy a part of the material every time the fungus is studied under the microscope.

Exceptionally pretty preparations can be made by the method now to be described. Very little apparatus is required. Slides (3 by 1 inch), coverslips (No. 1, 2 by $\frac{7}{8}$ in. are the best), a small spirit lamp, one or two dissecting knives, a glass rod, slide trays, and a few bottles for holding reagents are all that is necessary.

There should be three (or four) fair-sized bottles, the first containing pure xylol, another with a mixture of alcohol and ether:—

Alcohol (99%)	10 parts,
Ether	32 parts,

and the third containing a collodion mixture.

The formula generally used for this is as follows:—

Pyroxylin (soluble guncotton)	2 parts.
Alcohol (99%)	10 parts.
Ether	32 parts.
Castor Oil	1 part.
Lactic Acid	1 part.

Failing this, the ordinary collodion obtainable from any chemist can be used. A small bottle containing canada balsam dissolved in xylol will also be required, and a small bottle of absolute alcohol will be useful.

In the majority of cases perfectly satisfactory preparations can be made from dried leaves, but in the case of some ferns, for instance, which are very thin and brittle when dry, it is advisable to work with the fresh material.

The method is as follows:—Select a leaf on which the hand lens has revealed the presence of reproductive bodies, with the glass rod put a drop of collodion over the fungus and allow it to dry. A little experience will soon show how much collodion to apply, so that a sufficiently tough film is formed without its being too thick and opaque. When the collodion is dry, slip a dissecting knife under the film and raise it carefully—you will notice that the fungus adheres to the collodion—and place it on a glass slide. Dissolve a part of the collodion with the mixture of alcohol and ether, which will also cause the film to adhere to the slide, and allow to dry again; then flood the slide with xylol, let it run off, put a small drop of balsam on the preparation with a glass rod, and carefully lower a cover slip over the preparation. If the balsam becomes at all cloudy the collodion has not been thoroughly dried before applying the xylol, and the cover slip can be removed, the balsam removed with xylol, the xylol with a little absolute alcohol, and the preparation re-dried. If there are air bubbles under the cover-slip, which frequently occurs when the fungous growth is particularly dense, these can be removed by heating the slide gently over a small spirit lamp.

A successful preparation depicts the fungus exactly as it grew on the leaf surface. Microscopic preparations must be carefully labelled and given the number of the specimen from which they are taken.

The Fungi.

I have mentioned above that the majority of the black, superficial leaf fungi belong either to the family *Perisporiaceae* or to the *Microthyriaceae*. In describing the chief characteristics of these two families it will be necessary to introduce a few technical terms, which, however, should not present any difficulty when fully explained.

The *hyphae* are the spreading vegetative threads of the fungus, which are referred to collectively as the *mycelium*.

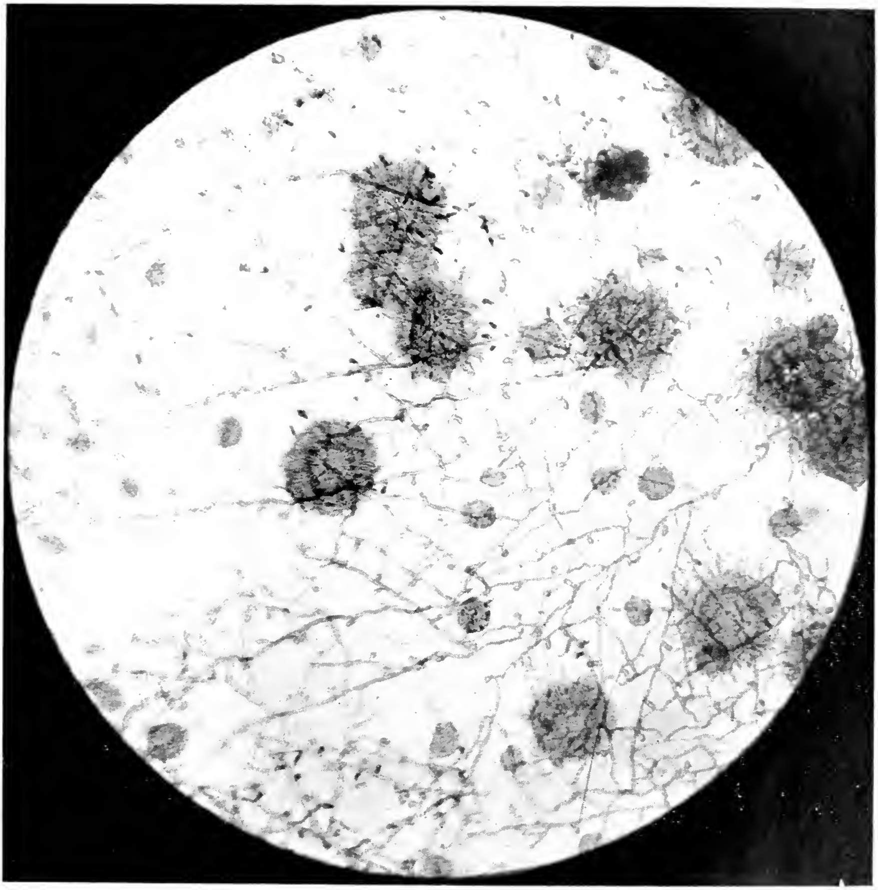


Fig. 4.

The *hyphopodia* are minute outgrowths of the hyphae, peculiar to these families, which occur at regular intervals on the hyphae, and which are regarded as undeveloped reproductive bodies or undeveloped sterile branches (Fig. 2, A and B).

The reproductive bodies are called *perithecia* when they are spherical and *thyriothecia* when they are flattened; they enclose small sac-like bodies the asci, each of which contains 2-8 spores. Each spore (Fig. 2 D) is capable of producing a small plant. Sterile erect branches are referred to as *setae* (Fig. 2 C).

With this preliminary explanation, we can proceed to note the characteristics of the two families. Fig. 3 is a photograph of a microscopic preparation of one of the *Perisporiaceae* (*Meliola glabra*). It consists of brown radiating hyphae, bearing hyphopodia at regular intervals; these are of two kinds, the most numerous are two celled, and rounded, they are known as capitate hyphopodia (see also Fig. 2 A), and are considered to be undeveloped perithecia; the other kind are less numerous, they consist of a single cell and taper to a short neck, they are almost bottle-shaped (Fig. 2 B), and represent undeveloped branches.

There are no setae in this particular species. In the centre of the spot there are several spherical perithecia, and scattered about there are a number of 5-celled brown spores, most of which are germinating.

The next figure (4) shows one of the family *Microthyriaceae*: the mycelium is similar to that in the previous figure, but is more slender, and there is only one kind of hyphopodium. The chief difference is in the form of the reproductive bodies, which in this group are flattened-hemispherical and formed of hyphae radiating from a central point. They are termed *thyriothecia.*

The characters, which are of importance in determining the genus to which a fungus belongs, are best expressed in the form of a key. I append a key to the more important genera of the two families, which may be of use to collectors:—

Perisporiaceae.

Perthecia spherical.
- A. Spores 2-celled.
  - a. Mycelium conspicuous.
    - 1. Perithecium containing one ascus .. .. .. *Balladyna.*
    - 2. Perithecium containing several asci.
      - o. Spores colourless.
        - x. Perithecia smooth .. .. *Dimerosporium.*
        - xx. Perithecia with setæ .. .. *Dimeriella.*
      - oo. Spores brown.
        - x. Perithecia smooth .. .. *Dimerium.*
        - xx. Perithecia with setæ .. .. .. *Phaeodimeriella.*
  - b. Mycelium none or poorly developed .. .. .. *Parodiella.*
- B. Spores 3 or more celled.
  - 1. Spores colourless .. .. *Zukalia.*
  - 2. Spores brown .. .. *Meliola.*

The genus *Meliola* is the most richly represented in South Africa, some fifty species have been described up to the present. Within the genus the chief points to be studied are the form of the hyphopodia, which may be rounded as in *Meliola glabra* (Fig. 3) or more or less elaborately lobed (Fig. 2 A); the presence or absence of setæ is also to be noted, and if present whether they are erect or curved, simple or branched. The tips of the setæ should be carefully studied, as some species are characterised by setæ forked or toothed at the tip (Fig. 2 C).

Another important point is the number of cells in the spore and the dimensions of the spores, perithecia and vegetative organs, and for this purpose a micrometer ocular will be required if it is proposed to study the fungi in detail and to determine species. Most collectors will probably be content to assign a fungus to its genus and send their specimens to the National Herbarium, Pretoria, for the determination of the species.

MICROTHYRIACEAE (after Theissen).

A. Mycelium wanting.
  I. Spores 1-celled.
    a. Spores colourless .. .. *Myocopron.*
    b. Spores brown .. .. *Vizella.*
  II. Spores 2-celled.
    a. Spores colourless .. .. *Microthyrium.*
    b. Spores brown.
      1. Thyriothecia circular .. .. *Seynesia.*
      2. Thyriothecia elongated.
        1. Paraphyses* present .. .. .. *Lembosina.*
        2. No paraphyses .. .. *Morenoina.*
  III. Spores 3-celled, brown .. .. *Scutellum.*
  IV. Spores 4-celled, brown .. .. *Halbania.*
  V. Spores more than 4-celled, colourless . *Phragmothyrium.*
  VI. Spores linear, thread-like .. .. *Ophiopeltis.*

B. Mycelium present.
  I. Spores 1-celled, brown .. .. *Lembosiella.*
  II. Spores 2-celled.
    a. Spores colourless.
      1. Mycelium with hyphopodia .. .. .. *Asterella.*
      2. Mycelium without hyphopodia .. *Calothyrium.*
    b. Spores brown.
      1. Thyriothecia round.
        o. Mycelium with hyphopodia.
          Thyriothecia dehiscing by a star-shaped slit .. .. *Asterina.*
          Thyriothecia dehiscing through the dissolution of the central cells .. .. *Englerulaster.*
        oo. Mycelium without hyphopodia *Asterinella.*
      2. Thyriothecia elongated.
        o. Spores colourless .. .. .. *Lembosiopsis.*
        oo. Spores brown.
          x. Paraphyses present .. .. *Lembosia.*
          xx. No paraphyses .. .. *Morenoella.*

*Paraphyses are sterile threads growing amongst the asci.

EXPLANATION OF PLATES VII., VIII., IX.

Fig. 1.—Leaves of *Curtisia faginea* (the Assegai wood) with black spots due to *Meliola ganglifera.*

Fig. 2.—A. Hypha with capitate hyphopodia.
B. Hypha with mucronate hyphopodia, (*Meliola Puiggarii*).
C. Different types of setæ.
D. Spores of *Meliola* spp.

Fig. 3.—Photomicrograph of *Meliola glabra.*

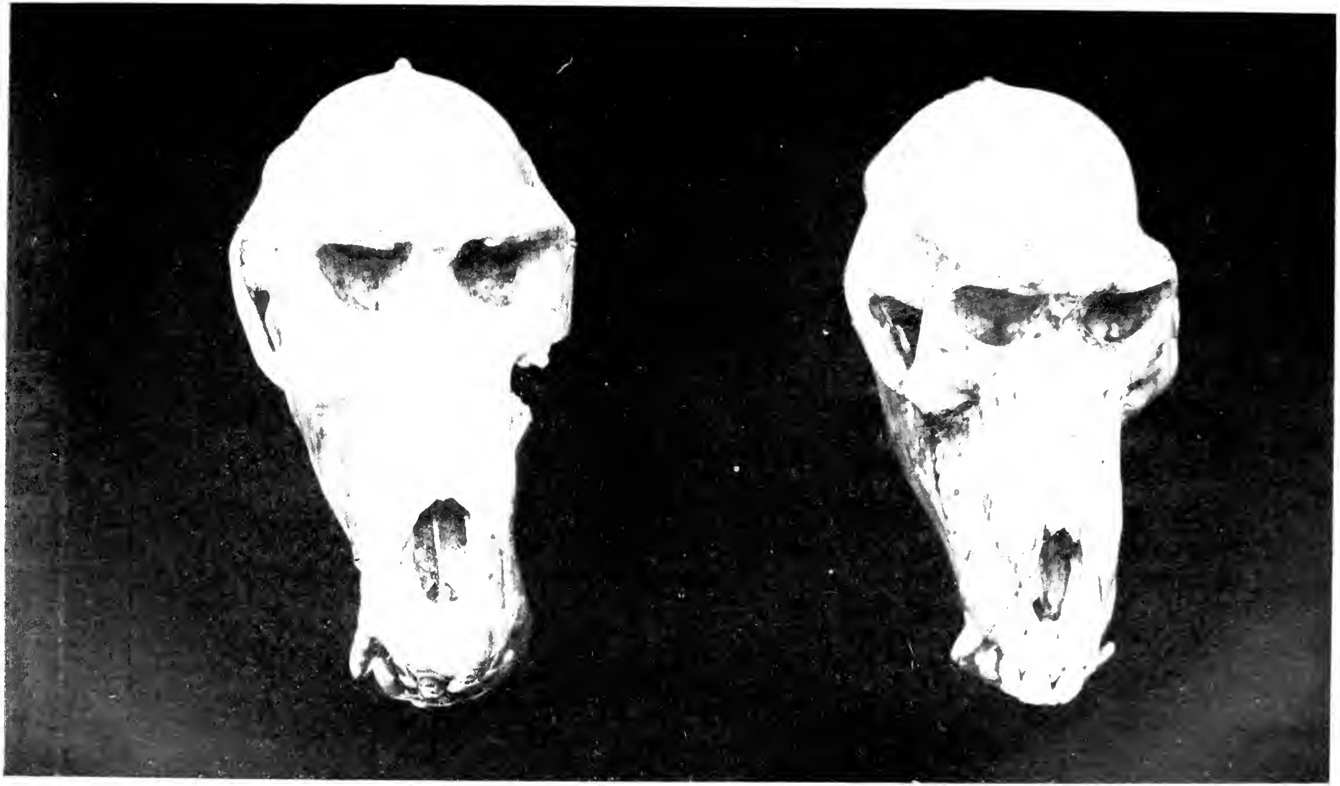
Fig. 4.—Photomicrograph of *Asterina* sp.

The Rhodesian Baboon (Choiropithecus rhodesiae, Haagner).

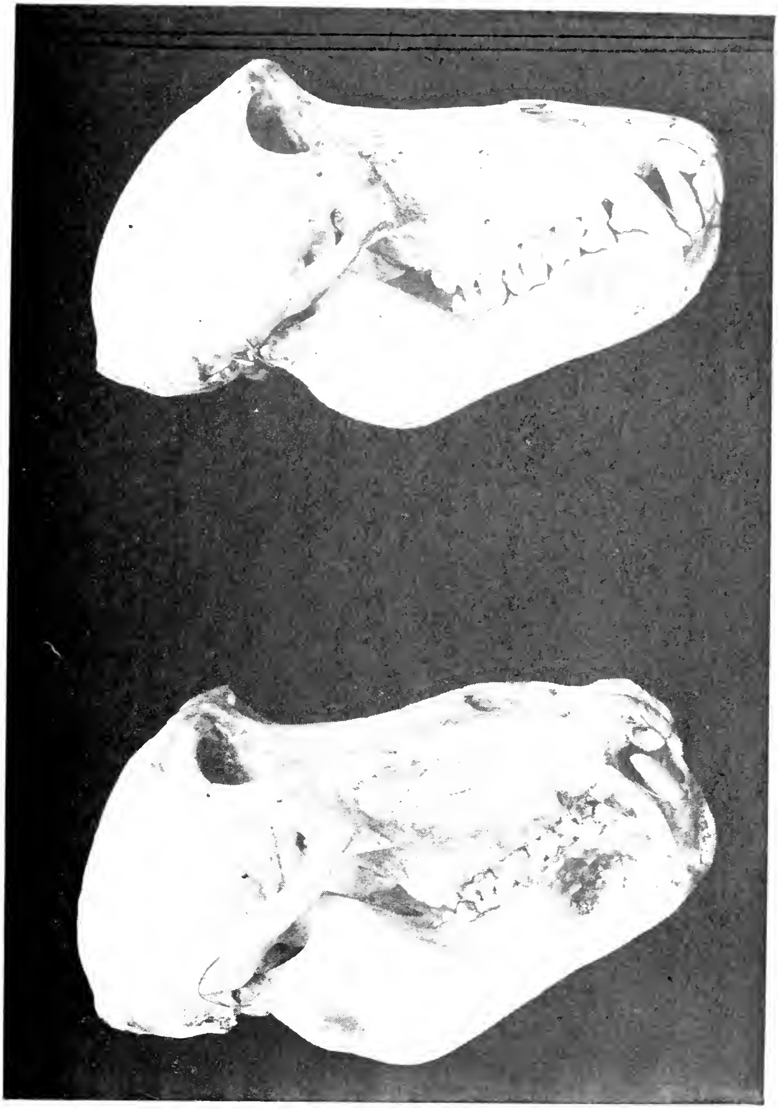
By A. K. Haagner, F.Z.S., etc., Director, National Zoological Gardens.

Since publishing my preliminary description of the Rhodesian Baboon in the first number of the South African Journal of Natural History (cf. Vol. 1, No. 1, p. 83, plate III), I received a flat skin and skull from Mr. E. Konschel, of Marandellas, Southern Rhodesia, which confirms my original opinion as to the novelty of the species. The specimen received is evidently from an older animal than the living example in the national collection, judging by the skull. The skin is darker along the spine and on the hips. The mantle of long hair on the spinal column is longer, the individual hairs ranging from 5 in. to a foot in length. Length of flat skin from tip of snout to root of tail, 3 feet 6 inches. Unfortunately the skin is a very bad one, is without the tail, and is impossible to mount.

I append some additional notes made from the skin, some of which were impossible to take from the living animal without chloroforming it:—The hairs of the upper surface of the body are ringed with alternate pale yellow and dark brown or black, the tips being dark. The hair of the nape is 5 inches long and somewhat erect, with long black tips making this region appear as a blackish patch. Hairs of spinal column up to 12 inches long, and also with long dark tips, forming a broad dark band down the centre of the back. Lower surface of body and inner sides of limbs very much paler than the sides, and with a yellowish tinge, owing to the tips being pale instead of dark. Throat and cheeks silvery white, the hair on the cheeks being short, thick and extending upwards in two bands until they nearly meet on the bridge of the nose. This is a characteristic I have never seen in any other species of baboon. Its heavy build—heavier even than the Chacma—grizzled ochraceous-brown fur,



Skulls of Rhodesian Baboon (left) and Chacma Baboon (rt.)



Skulls of Rhodesian Baboon (left) and Chacma Baboon (rt.)

and long muzzle preclude any possibility of its being confounded with the Yellow Baboon (*Papio cynocephalus*); and its distinctive coloration, long mantle of hair on the dorsal region, hands and feet if anything paler than the arms and legs, serve to differentiate it from the Common Chacma of South Africa—apart from the differences in the skull noted below. Sclater, in his "Mammals, Fauna of South Africa," states that the Yellow Baboon inhabits Rhodesia (Mashonaland), but I think that must be an error, as this animal is found along the coastal tracts from Delagoa Bay northwards, being replaced in Central Rhodesia by the Rhodesian Baboon, and much further West again (Bulawayo to Livingstone), as far as I can make out, by the S.A. Chacma. Certainly we have had ordinary Chacmas from the Bechuana-Rhodesian border, and one from Gwaai, but whether the authenticity of the latter locality can be trusted, remains to be seen.

Description of Skull of Rhodesian Baboon:—Parietals not so rounded or high as in *porcarius*, more like those of *cynocephalus*: sagittal crest more developed, although in very old Chacmas this is more advanced than that of the example on the accompanying plates; frontals wider; supra-orbital ridge well developed; squamosal not so deeply dented as that of the Chacma. Nasals long, and broader than those of the Chacma, the nasal opening or orifice being much wider and more open than that of the Chacma, resembling in this direction more the skull of the Yellow Baboon; maxillæ higher, with the ridges more pronounced than those of the Chacma Baboon.

Measurements (in millimetres).—Total length of skull, 217; zygomatic width, 120; occipito-nasal length, 171; intertemporal width, 61; median length of nasals, 77; length of upper canine 40 (tips badly worn); length of upper molar series, 61; lower molar series, 82; length of mandible, 162.

As will be seen from the above, the skull—like the rest of the animal—partakes of the characters of both the Chacma and Yellow Baboons.

The Study of South African Caterpillars.

By C. B. Hardenberg, M.A.

Preface.

During the last six years the writer has been especially interested in the study of the pre-adult stages of the South African Lepidoptera. Although a fairly considerable knowledge of this subject has been obtained, only the fringe of it has been touched upon, and a great amount of investigation remains to be done. This article is therefore written to call attention to this absorbing and greatly neglected branch of entomology and to arouse interest in it on the part of collectors and co-workers. While investigating the insects injurious to the Black Wattle, a great deal of time was spent in the collecting and rearing of the caterpillars found in the plantations. The rearing was sometimes successful, but often not. In the latter case, not a rare occurrence by any means, the disappointment and dissatisfaction were great and often lasting, as species plentiful one year might be very scarce or apparently absent the next season. And while thus collecting and rearing we often wished for a little book which would enable us to determine the species from the larva, a kind of "Guide to the Caterpillars." Comparison with prepared specimens of caterpillars in Museums and private collections usually proved unsatisfactory, as in the process of preparation the most striking characters had often been lost. Then we looked up descriptions of caterpillars. These we found scattered through a great number of periodicals, often inaccessible. When found, the description was often very short and vague, leaving one in doubt as to whether the caterpillar in hand was identical with the one described or a nearly related species or whether the description referred to another instar of the larva than that of the one which we wanted to identify.

The time for the preparation of a booklet for the determination of the South African caterpillar has not yet arrived, and will not arrive for a considerable time. What is needed first of all is assiduous collecting and breeding of caterpillars with careful and detailed descriptions. The writer will be pleased to receive any immature stages for study and identification if possible. Fresh or prepared material, alcoholic or dry, will be equally acceptable.

INTRODUCTION.

The pursuit of entomology in South Africa has thus far been confined mostly to the collecting and classification of the adult forms. This is only natural in a country which is, entomologically speaking, quite young. Yes, we would go even further, and say that the forming of a representative collection and the identification of or naming and describing of the various species is the first essential, the pioneer work in entomology. In order to know what we are writing about, the species under discussion must have a name. And while a great deal still remains to be done in this direction, there are now some very fair representations of our insect fauna in the various collections of museums and private individuals in South Africa.

But amongst all these thousands of insects thus brought together, there are only a very few of which the immature stages are known. Confining ourselves to the Lepidoptera, as in the other orders a still smaller percentage of the pre-adult stages have been studied, we find that thus far only a small proportion of the caterpillars have been described and figured. And these are for the greater part only the larger and more conspicuous ones, or such as are of economic importance; the former on account of their striking characters as regards size and markings, the latter because the study of the life history of the species was found to be essential.

Such descriptions as exist are for the most part rather vague, and, in most cases, based only upon the full grown larva. While the larger and more conspicuous caterpillars are such as those of *Saturniidae, Sphingidae, Lasiocampidae, Zymantridae* and the *larger Rhopalocera,* can usually be recognised from the descriptions and figures, in their corresponding instars, when we come to the smaller and less strikingly marked species, we find that the "description" usually fits equally well the caterpillars of several nearly related species, and is thus not of any use for the identification of any particular larva which we may have found.

But, even with the existing descriptions, the number of Lepidoptera of which the caterpillars are known remains negligible when compared with that of the adults, and thus the study of the immature stages offers a field for investigation practically unexplored. Hence the certainty that every collector will discover something new cannot fail to stimulate the interest in this neglected branch of entomology.

Importance of the Study of Caterpillars.

Apart from the pleasure of finding the caterpillar of a certain moth or butterfly, hitherto only known from the adult form there is considerable importance attached to the knowledge of these immature stages. We shall consider this aspect of the question from (*a*) the standpoint of the collector, (*b*) its economic importance, and (*c*) the scientific value of this study.

(*a*) *From the Collector's Standpoint*:—We can safely assume that the formation of a collection indicates an interest in Nature and the insect life which plays such an important part therein; *ergo,* in insect biology. Now, a collection of adults only fulfils part of the object aimed at; it shows us which insects do occur, but gives us no information in regard to the part they play in the scheme of Nature. After the question: "What is it?" comes the question: "How does it live?" It is now generally being recognised in the museums that a collection, whether for display or for study, is incomplete when only the mature forms are represented and that these must be accompanied by the immature stages, food-plants, etc.

And there is still another incentive for the collector to look for the larvæ in the field. With the ordinary methods of collecting, be it with the net or at light, many specimens are either damaged or such as are captured are found in an imperfect condition, and many collections are rendered unsightly by the presence of such broken and rubbed specimens. Collectors therefore have realised that the only sure way to obtain specimens in their pristine beauty is to breed them, and many are now making special arrangements for doing so. And when the object is to obtain long series of a certain species for the study of individual variation, this can only be accomplished by breeding.

It is principally through the efforts of so many of the older collectors, who wished to obtain perfect specimens, that a great portion of the caterpillars of the *Rhopalocera* and of the larger moths have become known and have been figured and described.

Lastly, there are many species which cannot be obtained in any other way, as they are never seen at the time when net collecting is being done and are not attracted to the light in the evenings. Such are the majority of the *Psychidae* and many *Tineidae*. While the larvæ of these may be very plentiful, the adults are rarely found in the collections, and breeding is the only method by which these can be secured. Many species which hitherto have been considered great rareties can thus be obtained in number.

(*b*) *The Economic Value of the Study of Caterpillars*:—Considered from the standpoint of the economic entomologist, the larval stage is usually the most, if not the only important one in the case of injurious insects. This is especially true in the case of *Lepidoptera*. The farmer or fruitgrower whose crops are being destroyed, or the forester whose plantations are being defoliated, usually notices only the caterpillars, and in this form the insect is sent in for determination and for advice as to the best remedial measures. In order to enable the entomologist to deal with the matter promptly, he must be able to recognise the insect in this stage; as, if he must wait until the species has been reared to the adult stage to determine it, the damage has been done and the advice comes too late. To make a ready identification possible, a reference collection of the caterpillars of these injurious insects must be available, or such descriptions as will enable one to determine the species in question with certainty. Otherwise it may happen that some injurious larva is confused with a harmless one or *vice versa*; the more so as there is sometimes a very close superficial resemblance between caterpillars of these two groups.

(*c*) *The Scientific Value of the Study of Caterpillars*:—During the last decades the immature stages of the *Lepidoptera* have been the subject of careful examination and study on the part of the leading specialists, both in Europe and elsewhere. While the present classification is based on the characters of the imago, a study of the larva often discloses the relationships of the various families, etc., better than the adults. This is not the place to go into details, and the matter has been discussed more fully elsewhere. However, I desire to point out that for the purpose of tracing relationships, caterpillars in their first instar are the most important, and one should therefore never lose an opportunity to collect the eggs and save the newly hatched larvæ.

THE COLLECTING OF CATERPILLARS.

While it would be an exaggeration to state that caterpillars occur everywhere, we may safely say that they can be found almost everywhere. By this I mean that they can be met with in the most unlikely situations. Although, during the feeding period, the majority will be found on or near their food-plant, there are several species and groups of species which, when full grown, travel for a considerable distance to find a suitable place for pupation. As far as our present experience goes, this is most usually the case amongst the *Psychidae*, *Syntomidae*, *Arctiidae*, many *Noctuidae* and the sack-bearing caterpillars of the *Tineina*. We can find these under stones, on fences, posts, walls, amongst debris, in cracks and crevices, etc. *Hepialidae* are found in tubes underground, various of the smaller *Tineids*, *Pyralids*, etc., in seeds and fruits, in plant-galls, etc. Others may be found in ants' nests, and a termitophilous moth larva of peculiar structure lives in the nests of the white-ant *Rhinotermes putorius*.

From a collector's point of view we may roughly divide the caterpillars into two groups, those which are conspicuous and those which live more or less concealed. The former are usually such as are very hairy or of bright coloration. It is hardly necessary to look for them as we cannot fail to see them; they flaunt their colour in one's face. It is to this group of caterpillars that the majority of the described and figured species belong, as the collector, while really out for other insects, could not help noticing them. They are usually distasteful to birds or have some other disagreeable characteristics, and their conspicuousness is generally a warning to leave them alone.

Not so with the other group which comprises the majority of the caterpillars. To detect them, careful scrutiny is often necessary. The first important requisite is to become familiar with the normal habitus of the plants, so that anything strange in its aspect will at once draw the attention. This rule, of course, does not apply to the collecting of caterpillars only. A ragged edge to a leaf, normally showing a smooth border, will suggest a caterpillar hiding underneath; leaves folded, curled or drawn together will make us think of a *Tortricid*, *Tineid*, or, in the latter case also a *Hesperid*; a wilted top to a branch may show the presence of a borer; a sunken and discoloured spot on the stem of a tree may betray the activity of a larva underneath; webbed frass on the stem may be caused by an *Arbelid;* thorns on a branch of a tree which is smooth barked may be made by a *Geometrid* in its resting position, or a bagworm. In fact, the various abnormalities which one meets with during a day in the field are too numerous to mention, and each has its significance.

But, notwithstanding a sharp eye and a quick apprehension of the cause of anything abnormal, there are several species which would still escape our search; for these species other methods will be found necessary. The use of the sweeping net over grass and low herbage will often yield a good harvest of caterpillars which otherwise could be obtained only by a very laborious search; a search which in many cases might remain unsuccessful, as the larvæ might drop to the ground when disturbed and could not be found again amongst the roots and debris.

For caterpillars on trees and shrubs we have obtained excellent results from beating and shaking the branches over an umbrella, one which has a white inside lining covering the ribs is most suitable for the purpose. The branch must be beaten or shaken *suddenly* and *vigorously* as a preliminary *slight* jar will, in the majority of cases, cause the caterpillar to hold on more tightly.

But there is still another class of caterpillars which mimic their surroundings so closely and keep themselves so quiet as to deceive even an experienced collector. This applies especially to such as live among the lichen on trees, or hide in cracks and crevices on the trunk. As long as they remain motionless it is in many cases almost hopeless to look for them. In several instances of this kind I found that blowing a puff of smoke over the place suspected will cause a sudden movement on the part of the caterpillars so that they can be located and picked off, or, if too deeply withdrawn to be readily extracted, they can by continuous smoking be induced to leave their hiding places. But one must be careful. Some of these, although perfectly quiet while left alone, will, upon being disturbed, by means of a sudden contraction, actually jump away from the tree and be lost among the litter on the ground. To provide for such a contingency, it is therefore always well to hold the hand or a net under the place which is being examined.

And, lastly, we must not forget that a great number of the smaller species are leaf-miners or live in seeds, fruits, the heads of *Compositae,* etc. These are better collected when the fruit is ripening, because then there is less chance of the larva dying through lack of the necessary moisture. The gradual drying out of the material approaches to the natural condition.

When collecting caterpillars it is a common mistake (which we have repeatedly made ourselves) to cram a great number of miscellaneous larvæ into one box. Apart from the certainty of getting the food-plants mixed, the larvæ, when crowded, will often injure each other or become soiled with excrement, or the moisture in the box becomes excessive. These conditions quickly affect the caterpillars and reduce their vitality, making subsequent rearing a difficult matter. One should go provided with several small boxes; the various species, or such as appear to be different, should be kept separate, and a piece of the food-plant should be included. If the food-plant is known, its name should be jotted down at the time; if unknown, various parts of the plant, especially flowers and fruit, should be collected and the different kinds distinguished by a number. Then, at home, some of our botanical friends will probably be able to name the plant. If the species of plant does not grow near our home, we can most probably find a representative of the same genus, or even family, nearby which can be offered to the caterpillar. In most cases we shall find that there is little difficulty in rearing the larva on this substitute, especially if the caterpillar is nearly full grown when collected. Young larvæ are often more particular about their food and more troublesome to rear.

To Obtain First Instar Larvae.

For this purpose it is, in most cases, necessary to obtain fertile eggs and have them hatched indoors. It is only in exceptional cases that the first instar larvæ are readily collected in the field. Unfortunately for the collector, these eggs are very often parasitised; our experience has been that, if the egg mass has been found by a female parasite, she has done her work so thoroughly that not a single egg in the cluster has escaped being stung. The most satisfactory way is, therefore, to obtain the eggs from the female moth or butterfly. While it is comparatively easy to collect the eggs of the larger moths, those of the smaller kinds are more difficult to locate; in fact, in many cases we do not know where the eggs are deposited or where to look for them. Fortunately, very many of these smaller moths are attracted to the light. The females, as a rule, contain eggs, and these eggs are, in most cases, fertile (contrary to our previous ideas). The females which one captures at the light should therefore not be killed at once, but should be imprisoned under the lid of a box or a tumbler until the following morning. As a rule we shall find that eggs have been laid overnight, and the moth will be still quite fresh and can then be killed for the cabinet. A description of the colour markings and other peculiarities of the eggs should then be made, a few of the eggs preserved in alcohol, and the remainder left to hatch.

Preparing Caterpillars.

The usual procedure on the part of the collector when he finds a nearly full grown caterpillar is to try and rear it through to the adult so as to be able to tell which species it represents. It is a natural curiosity which he wants to satisfy. But a little consideration will show that this is really the wrong procedure. Probably in nine cases out of ten the adult will be a known species, while its caterpillar may not have been known. In the process of rearing through we have obtained the adult, but we shall probably not remember the larva. Thus science has not been advanced, and we are as far as we were before in regard to the species.

The first specimen of a larva should be preserved; the next reared to the pupa stage and this preserved, and only after we know these two stages should further caterpillars be carried through to the adult stage. Of course, in the majority of cases, there will be sufficient material collected to allow both larva and pupa to be kept and the adult to be reared, but uncommon caterpillars, which are only occasionally met with in small numbers, should be treated as I have indicated.

The first thing to do is to make a recognisable description of the colour and markings of the caterpillar, as it must be remembered that in the majority of cases these colours will disappear or change in the process of preservation.

The caterpillars should be preserved both for subsequent study and for display in the cabinet.

Preservation of Larvae for Study.

The preserving fluids used most commonly for this purpose are alcohol, formalin or alcohol plus glycerine in equal parts. The first is to be preferred. Formalin is said to preserve the natural colours to a certain extent, but we have found its assistance in this matter very slight. It has, moreover, the disadvantage of being disagreeable to handle and of making the specimens too brittle for future study. Alcohol-and-glycerine mixture has the advantage that, if the alcohol evaporates—the cork is not always close fitting—the specimen will not dry out, but will remain moist through the hygroscopic qualities of the glycerine it contains. But it has this disadvantage, that, if the specimen be used later for dissection and the mounting of parts as permanent microscopical preparations, the glycerine present makes thorough dehydration a very difficult matter. Pure alcohol of between 70% and 80% we have found the best. Before putting the specimen into the alcohol the larva should be killed by dropping it into boiling water and should be left there for a few minutes. Death is practically instantaneous, and the larva at first contracts, but after a few minutes stretches to its fullest extent. This allows all structures on the segments to be easily examined. Also, the boiling sterilises the contents of the larva. If this is not done, it often happens, especially in the larger specimens, that the alcohol will not penetrate quickly enough throughout the larva to prevent decay of the inner parts. The result is that, in many cases, we have, after a short time, a half decayed, flaccid larva, suspended in a murky fluid, and hardly fit for future examination.

The first alcohol should be renewed after about ten days.

Preparing Larvae for the Cabinet.

Although much has been written on this subject and many methods have been proposed, the ideal procedure, which would show the caterpillar as it appears in nature, has, to our knowledge, not yet been found. The method which, with all its adherent disadvantages, has proved of the most satisfactory thus far is that of emptying the larva of its contents and inflating the skin over a small oven until dry. The procedure which I have seen followed in the majority of cases is this: The larva is killed either by cyanide, choloform or ether, a pin inserted into the anal opening and by turning this around, the connection between the rectum and the skin is severed. Then the larva is pressed by rolling a pencil or a glass tube over it, starting behind the head and working towards the posterior end, and thus the contents of the caterpillar are removed. Then a straw or a glass tube is inserted into the anal aperture, the hind part of the larva tied or glued to it, or held to it by means of a small clamp, and the skin inflated over a small oven until dry.

The straw or glass tube is then removed. A small piece of wood is inserted and glued in, and the larval skin is thus mounted by means of a pin stuck through the wood behind the skin, or, the inserted straw having been removed, the empty skin is glued to a cloth-covered piece of wire, by means of the prolegs, and the end of this wire is wound around a pin.

But this method has the serious disadvantage that, at least in most cases, the posterior part of the larval skin is spoilt by being tied to the inflating tube and eventually being glued on the mounting straw or stick; in the other case, the prolegs are also all glued up by being mounted on the wire. Some important parts of the larva are thus rendered unfit for future examination.

An improvement on this method was suggested to me by Mr. Janse, and proved quite successful. This method, with some change which our own experience taught us, has given us results which compare very favourably with the specimens of blown larvæ prepared by the old method.

First, the caterpillar is left to starve for a day or more in order to render the alimentary canal empty or practically so. The caterpillar is then killed in the cyanide jar and left for from twelve to forty-eight hours, depending on its size. At the end of this period a certain amount of decay has taken place which will be of assistance in the following stage of the process. The larva is now taken out of the cyanide bottle and put on a piece of clean white blotting paper. Another piece of this paper is put on top of it and gentle pressure applied, starting behind the head of the larva and working towards the posterior end. The intestinal wall having partially decayed, tears loose somewhere in the thoracic cavity, and is evaginated through the anal opening, whence it protrudes. This is now cut off, a straw of suitable size inserted, and by means of a small pair of forceps this alimentary tube is moved further and further up along the straw until the latter reaches to the head of the larva. If the straw is wetted it will greatly facilitate its slipping in. Having the straw inserted throughout the entire length of the larval skin will prevent the sides from adhering to each other, or the larva from dropping down too near the hot plate during the blowing process, in case the pressure gives out. It also gives additional support to the larva when mounted. The skin is now tied on to the straw, the string running around the projecting rectal tube. In this way no part of the larva is distorted or destroyed; and, if properly done and well tied, there is no leakage and the skin will hold pressure. It is now inflated in the usual manner, applying the heat slowly at first. The heat should be gentle during the entire process. It is true that a very hot oven will hasten the drying, but in the case of hairy larvæ the hairs may become singed and turned at the ends, and there will be much more discolouration than when gentle heat is applied.

It is inevitable that the colours, especially in the thin-skinned caterpillars, change during this process, and sometimes even pass beyond recognition. The colours which tend to keep best are the dark blue, red, yellow, brown and gray; the greens will turn to yellow, the yellow to orange, and the light blues have a tendency to disappear altogether. But a great deal can be done towards preserving those colours by not pressing the larvae out too clean (this applies especially to the thin-skinned kinds), and by applying only a very gentle heat during the entire process of inflating.

A great drawback to this inflating process is that the skin often stretches far too much, thus giving the caterpillar an unnatural appearance. We have found that this can be prevented to a certain extent by allowing the empty skin to soak in 5% formalin for a couple of days. This will somewhat harden the intersegmental membranes and, if the air pressure applied in the blowing be not too strong, the inflated larva can be held down to more or less normal proportions.

For the preparation of the very small larvae, such as first instars, the small *Tineidae*, etc., it had been advised to heat the entire larva in a test tube over a small flame. At first the larva contracts and the stigmata are closed. By continued heating the air contained in the larva causes it to expand and stretch out again. But this method has not proved very successful with us and we have abandoned it in favour of inflating even the smaller caterpillars in a manner similar to that described for the larger ones. This takes a steady hand, great care and much patience; but the results well repay the trouble. The small larva can be killed in the usual way. It is then boiled in weak potash solution. By continued boiling we find that sufficient of the alkali penetrates to soften the tissues inside and after a while we find the practically empty skin with the greater part of the alimentary canal projecting from the back. Then the larva is soaked in hot water to remove the potash, then transferred to a small dish of alcohol. Under the dissecting microscope the alimentary canal is cut off square a short distance behind the larva and a glass tube, drawn out to a fine point, inserted. When we take the larva out of the alcohol we find that the rectum soon dries to the tube, making tying-on unnecessary; or, the larva can be tied on in the usual manner. The inflating of these small larvæ takes only a few minutes. Then the glass tube is broken off a half inch or more behind the end and inserted into a piece of Polyporus pith; this is then mounted by means of a second pin, to make a very neat double mount.

The larger caterpillars, when blown, are not removed from the straw, but mounted by means of a pin through it. Now it often happens that this straw splits, and also, the thin walls of the straw do not give sufficient hold on the pin so that the mounted caterpillar has a tendency to fall away at the slightest jar. To overcome this difficulty we made several trials while at New Hanover, and Mr. Haines found that the petioles and midribs, as also the flower stalks of the "syringa," *Melica azedarach*, possessed all the qualities for making satisfactory mounts; they do not split, do not corrode the pin, and grip the pin tightly. They are best collected for this purpose in the autumn when the leaves are about to fall. A piece of suitable diameter is inserted into the hollow of the straw which projects beyond the larva and then the mounting pin will have a firm hold.

These syringa sticks can also be used for the double mounting of the minute larvæ, the glass tube being pushed into the pith of the syringa and the mounting pin pushed through the latter.

The Breeding of Caterpillars.

With the collecting and preparation of those caterpillars which we happen to find in the field we have not completed the life history of the species. The caterpillar, having a hard, inelastic chitinous skin, is capable of only limited growth, after which the skin becomes too small. Then a new skin is formed underneath, and the old one splits and is stripped off. This process is called moulting and the stages preceding these moults are the corresponding instars. Thus, the stage between the time the egg hatches and the first larval moult is the first instar, that between the first and second moult the second instar, and so on. The cast skins are called exuviæ. A caterpillar goes through several moults before pupating and the various instars are often quite different in appearance, i.e., in colouration, ornamentation, and armature. The description of a caterpillar in a certain instar may therefore not fit the species at all in the preceding or following instar. Now it is very seldom that we have the opportunity of watching a caterpillar in the open on its food-plant during its entire larval life and of collecting samples of each instar. To obtain these it is necessary to breed the caterpillar in a place where it can be kept under continuous observation; that is, in a breeding cage, so that all moults can be observed and the various instars studied.

Various types of breeding cages have been devised and may be obtained from dealers in entomological supplies. But breeding cages which will suit the majority of our breeding experiments can be made quite easily by the collector himself with very little trouble and expense. For caterpillars requiring special conditions, such as root-feeders or other underground species, special cages have to be made. But for the majority of the caterpillars subsisting on leaves, fruits, wood, seeds, etc., the cage need not be elaborate. The important point to be kept in mind is that the new surroundings in which the caterpillar finds itself should approach as nearly as possible the natural conditions. This means that there should be plenty of ventilation, light, fresh air, and—a very important point—cleanliness.

As regards ventilation, caterpillars collected in the field have been accustomed to an unlimited quantity of fresh air and the change to the stuffy condition of a closed breeding cage is apt to have a deleterious effect. Therefore, the breeding cage should never be entirely closed. Also, the moisture, given off by the food-plant and the larva, would very soon make the atmosphere much too damp and disease may follow. It is therefore advisable to have at least two sides of the breeding cage entirely or partly made of gauze to allow free passage of air. Even for such caterpillars as feed in the interior of their food this is the best plan to follow, for to those which live in partly dried-up seed pods, wood, etc., a gradual drying out of the material is a natural condition and thus would not interfere with the normal development of the larva. Glass jars or similar containers used for breeding should have the top covered with cheese-cloth or mosquito net.

As to light: it is best to have the breeding cage so constructed that there can be an abundance of light, as the light in the room is always considerably less than outdoors. For such caterpillars as are found in more shady situations the light can be diminished by putting the breeding cage farther from the window or, if necessary, covering the cage with a cloth or paper. We can easily subdue the light but we cannot add to it. Thus the breeding cage should have two sides made of glass. We have found that the cages made of wire gauze on all four sides are in many cases too dark for larvæ which are surface feeders; the caterpillars do not seem to thrive and are retarded in their development. This does not matter so much if we are merely desirous to obtain the various instars of the caterpillar, as long as it lives and goes through its transformations, but it is a great drawback if at the same time we wish to secure data on the length of its various instars, its behaviour, etc.

As to moisture: sufficient moisture must be supplied to keep the food fresh. This is most easily done by putting the twig of the food-plant into a small tube containing water. But the space left between the twig and the edges of the vial must be filled up with cotton wool to prevent small larvæ from dropping down or crawling down the stem into the water. A wide bottomed small bottle is preferable to a narrow vial as in the latter case the weight of the larvæ on the leaves is apt to disturb the balance and make the vial fall on its side, spilling the water and wetting the food and the larvæ.

Cleanliness is of prime importance. No frass or droppings must be allowed to accumulate on the bottom of the jar. When the sides and bottom of the breeding cage are kept clean, the contents can be better observed while any cast skins can be readily noticed. Further, debris and excreta soon go mouldy and this condition renders the air unhealthy for the larvæ and promotes disease. This may sound so self-evident as not to be worthy of mention but it is surprising how often we have found this simple precaution, which is the cause of the failure of so many breeding experiments, overlooked.

Another important point in connection with this breeding is close attention and careful inspection. The cages should be looked over at least once a day, say every morning, fresh food supplied, and the cage cleaned out. When the caterpillars have pupated and the imagines are expected to appear shortly, the cage should be inspected twice daily, in the morning and in the late afternoon at dusk, as these appear to be the favourite times for the emergence of the adults. If an entire day and night are allowed to elapse between the examinations, we often find that the moth or butterfly, as the case may be, has been flying about in the confined space of the breeding cage; and, as a result, the specimen has become rubbed and otherwise damaged.

The adult should be removed as soon as its wings have become fully expanded and hardened. In the case of some *Psychidae* the moth starts flying almost immediately after the wings have become fit for flight; these insects must be carefully watched during the entire process of emergence and must be killed the moment they show signs of restlessness after the wings have dried.

With most butterflies we find that they also start flying soon after emergence. In the case of the larger *Heterocera* however, a considerable time is allowed to elapse between emergence and flight. No rule can be given which will hold good in all cases, and experience is the only reliable teacher. But it is advisable to keep close watch on the newly emerged individuals and kill them as soon as they begin to show signs of restlessness.

Recording of observations and the keeping of notes.

This by far the most important part of the breeding work, is unfortunately, also the one which, thus far, has received the least attention. The great majority of our South African collectors rear the insect from the younger stages, either for the sake of obtaining perfect specimens of the adult forms or for the purpose of having representatives of the caterpillars in the cabinet. What usually happens is this: A collector, while on the hunt for the adult forms, sees some striking caterpillar and takes it home with him. If several specimens of the one kind are obtained, a few are blown for the collection, the others put in a jar with a few leaves of the food-plant in the hope that the caterpillars will prove to be nearly full grown, pupate and disclose the imago in due time. Some more careful workers will go to the trouble of collecting fresh leaves of the food-plant from day to day, or at more or less regular intervals, but many others feel that they cannot spare the time for this, and trust to luck in obtaining pupa and adult. Such work is, of course, of very little value. but even many of the most careful breeders, while noting the various transformations, do not take the trouble to write them down, and the result is that in trusting entirely to memory, many details are forgotten and even such as are remembered are not available to other collectors.

An immense amount of data as to food-plants, transformations, seasonal abundance, etc., have thus been gathered by the various entomologists but have not been put on record and are thus inaccessible to others. This is a great pity as it simply means that another worker has to do the same things all over again.

Now, what is worth doing at all, is worth doing *well*, and therefore, a little extra trouble should be taken and all the observations written down. Even if the collector himself does not feel inclined to publish the data (and I have noted that some of our most careful and reliable breeders are very shy of having their records published, because they are incomplete) they can be of great service to one who makes the immature stages his special study.

I have found the following scheme to work very well in the wattle insect investigations at New Hanover, and while not perfect, publish it here in the hope that it may be of service to others who, quite likely, may improve on on it to suit their own conditions.

Let us suppose a miscellaneous lot of caterpillars has been found, and secured with parts of their food-plants. Arriving home we carefully sort out the caterpillars into groups of such as appear to be alike and put those of each group into a separate breeding cage. These breeding cages receive successive numbers, say 1, 2, 3, 4, etc. For each breeding cage a separate file is kept into which are put all observations relating to this breeding cage. Of the caterpillar a detailed description is made as to colour, pattern, and at least one specimen is preserved for study of structural characters; another one is blown for a cabinet specimen. The cage is looked over from day to day, and a daily record kept. At every inspection a careful search is made amongst the frass and excreta for cast skins, and, when found, these cast skins and headcases are preserved and labelled B.C. No———, with date. When there are several caterpillars in one cage we find that they do not all moult simultaneously as a rule, and at least one which is on the point of moulting, as also a newly moulted larva should be preserved, so as to get representatives of the beginning and of the end of an instar. A couple of days after the moult another larva, which has then obtained the full colour pattern and armature characteristic of the instar, must be preserved. Again, before preserving make a detailed description of the larva.

If this plan be carefully carried out throughout the various larval instars and the pupa stage (specimens of newly-formed and mature pupa having been preserved), we ultimately get a complete record of the immature stages of the insect, showing:

(*a*) dates of moulting, and thus number and duration of instars,

(*b*) colour pattern of the larva in its various instars, and thus the changes occuring with each successive moult,

(*c*) notes on the habit, food-plant, etc., of the caterpillar,

(*d*) specimens of the larva in its various instars for study of the relative position of setæ, armature, etc., (*e*) parasites, etc., of the species under consideration,

(*f*) length of pupa stage, colour description of pupa, the changes in the aspect of the pupa, when nearing maturity, etc.,

(*g*) specimens of the pupa for detailed study,

(*h*) formation of cocoon and habits of pupation,

while every specimen, be it larva, pupa, cast skin or parasite obtained from, say Breeding Cage No. 1, will be labelled B.C. No 1 and dated.

Later on, if we are so fortunate as to obtain the image, the species can be determined and thus all notes, drawings, descriptions, etc., can be transferred to a file devoted to that particular species.

Even if the name of the species remains for the present unknown, the record will be of great value, as supplementing observations made by another breeder of the same caterpillar, who may have obtained the larva in a later stage, and has been successful in rearing the adult. Also the time is not so far distant when we will be able to determine the family, genus, or even species, from the caterpillar, which is one of our aims in this study of the pre-adult stages.

For the description of the colour pattern, Ridgway's Standard of Colours and Nomenclature should be used.

The Birds of the Buffalo Basin, Cape Province. II.

Warblers.

By The Reverend Robert Godfrey.

Phylloscopus trochilus (L.)—Willow Wren. This regular summer visitor arrives from its northern breeding-quarters in November. One obtained in 1912 on the 4th of the month by Mr. R. F. Weir at Bolotwa, constitutes the earliest known arrival in the Eastern Province. In 1914, on November 20, I heard the simple "woi-eet" of the Willow Wren, without, however, seeing the producer. Till the birds begin to sing they generally remain unnoticed, but from the beginning of February—which is their normal time for tuning up—till their departure in the last week of March, these tiny migrants from the north force themselves into notice by their continual singing. They frequent the mimosa area right up to the verge of the forest and also haunt trees planted around houses. On first striking up its tune, the Willow Wren stutters and stammers in the effort to find its voice, but within a fortnight it has acquired its full song, and continues practising it so faithfully till the time of its departure, that on its arrival in its northern home it spontaneously breaks forth in those lowly simple strains which betoken new life in the long-slumbering woodlands.

Sometimes the Willow Wren is detected in full song in the Eastern Province much earlier than the middle of February. In 1917 I heard it in Umtata on January 16th, and Dr. Walker, of Mqanduli, informs me that the Willow Wrens were during one season heard singing there throughout the summer. Year after year the Willow Wren visits the Pirie Mission-house, sojourning among the gum trees during the month of March, and cheering us with memories of the northern woodlands, where often in the northern spring we have wandered with ears alert to catch the first utterance of its song. The latest date for Pirie is March 29.

Eremomela flaviventris (Burch.)—Yellow-bellied Bush Warbler—has a place in our list on the strength of Trevelyan's record in the Appendix to Sharpe's edition of Layard. Stark's statement that the species "is not uncommon in the neighbourhood of King Williamstown" evidently regards the neighbourhood of that town as including very much more than the river basin in which it lies.

Sylvietta rufescens (Vieill.)—The Crombec—occurs occasionally near King Williamstown, and is represented in the local museum by three specimens. One of these was obtained in the town by Peter Smith on 10/4/06, another at the Pirie river by Frank Pym in September, 1909, and a third, undated, at Breidbach by A. Few.

Camaroptera brachyura (Vieill.)—The Green-backed Bush-Warbler—known to the Kafirs under the name of *nomanyuka*, ranges throughout the forest area and along the wooded banks of the rivers. Fearless little fellow that he is, he moves about among the undergrowth or on the ground, keeping his tail erect and often uttering the plaintive bleat from which his name of "Bush-goat" is derived. Being in great part a ground feeder, this species is frequently taken in the boys' traps.

These little bush-warblers display great ingenuity in the construction of their nests, and may fittingly be called the "Tailor-birds of South Africa." The nest itself, built at the beginning of November, is a cup-shaped structure of bright green moss, thicker in the walls than in the foundation; within the mossy shell lies a firm layer of the slender seeding sprays of *Galopina circaeoides*, mingled with some broad plant fibres, wiry lichens and pappus; and the lining proper consists of *Galopina* sprays, a little silvery pappus and some hairs. The nest is securely sewn to a leafy roof, the little tailors using as thread a white cobweb, or at other times yellowish silk strands of the finest texture. Where the birds obtain the latter thread is to me a mystery. The leaves forming the roof are pierced in many places, and the threads are sometimes passed over the rim of the leaf to bind the leaf-edge to the moss in a neat little stitch; often, however, the threads are knotted with a kind of clot on the upper surface of the leaf. Between the leafy roof and the suspended cup an opening is left at one end for an entrance, and the lower rim of the entrance-hole is neatly woven with a cottony substance. The ellipsoidal eggs, three, or sometimes two, in number, are opaque white and unspotted. The average measurements are 13.8 x 19 mm.

Apalis thoracica (Shaw and Nod.)—The Bar-throated Warbler—is resident and widely distributed, haunting not only the dense forests, but occurring also by scrub-bordered streams, amongst the mimosa bushes and about garden hedges. It occurs generally in pairs, and betrays no desire to gather in companies, but when undisturbed clings tenaciously to its chosen haunts. These little birds seldom hunt at any great height from the ground, but search assiduously for their insect prey amongst the undergrowth and about the lower parts of the bushes. They are generally on the move from twig to twig, but sometimes hang tit-like in an inverted position to pick up, from a lower level, an insect within reach of the down-stretched neck. Where unmolested, they become quite fearless and prove themselves real friends of the gardener; one will even at times visit the verandah of a dwelling house and hunt about the trellis-work for the lurking insect-life. On the ground, where, however, they are not often seen, they proceed by short hops in recognised warbler-fashion.

As they move about in the undergrowth, they keep uttering a low call *dyoop* or *dyoont*, which they frequently lengthen out into *tyoop-tyoop-tyoop*.

At the beginning of August, these Warblers assume a noisy, rustling flight, probably associated with courting: soon afterwards, even as early as the 8th of the month in Griqualand East, they may be seen carrying about nesting-material; but, as far as present records show, the nest in Eastern Cape Colony is not built till considerably later, the earliest date on which a nest with its full complement of three eggs was found at Pirie being November 18. Other nests were brought in up to December 20.

The nest, placed in a bush a few feet from the ground, is a pretty domed structure, made of slender lichens lined thickly with vegetable down and with a thin inner lining of the seed-sprays of *Galopina;* it is covered externally with moss and lichens, profusely dotted over with spiders' cocoons and cobwebs. The eggs, three or even two only in number, are pale green, with dots and spots of various shades of brown scattered over the surface, more sparingly at the narrow end. They measure 13 x 18 mm. In 1918, at Somerville, on the morning of November 14th, the excitement of the pair of birds that live in our garden told me that they had young, and a search for the latter resulted in their being seen already at large among the orange-trees. One of the adults, presumably the female, came repeatedly close to me, and, in a crouching attitude with wings spread and tail slightly expanded, kept calling *jeerp jeerp*, a more emphatic form of the *dyoop*.

Apalis florisuga (Licht.) Rchw.—The Yellow-breasted Bush-warbler—was taken by Trevelyan in our area, and recorded by Sharpe under the name of *Euprinodes flavida*. This is now known to be one of our commonest bush-warblers: along the upper and the lower margins of the Pirie forest it is widely distributed and resident. There they hunt for insects on the sunny side of the forest-edge, as well as on the outlying scrub. They move about like willow wrens, and so closely resemble in their upper plumage the foliage among which they are sometimes seen hunting that they would easily escape notice but for the shaking of the leaves. Though common, they are seldom taken by the boys, and were brought to me on four occasions only during my residence at Pirie. Away from the forest, the species is found among the mimosa, chiefly in the neighbourhood of water.

Its ordinary call is a rough scolding note Djurre, not quite dissyllabic; in crying the bird holds its head forward and convulses its whole breast in the effort.

Prinia hypoxantha (Sharpe)—The Saffron-breasted Wren-warbler—belongs to a genus distinguished from all other South African genera of warblers by having ten instead of twelve, tail feathers; in the field it is distinguishable from the larger members of *Cisticolae* by the black streaks on the yellowish upper breast. This widely-distributed species occurs somewhat sparingly on the rank borders of the forests, in scrub by the rivers and in cultivated land. It is a restless and, at times, noisy bird; and, as it flits among the long grass-stems or hops on the ground, it carries its long tail erect and occasionally flirts it. It feeds on insects and their larvæ, and is one of the many species that fall victims to the caterpillar-bait of the native boys' traps. This bird can take a very tenacious hold with its feet; I have watched one, grasping tightly its perch over water, bend forward repeatedly to catch a fly without losing its equilibrium.

Locally, this warbler nests in November and December, choosing a bush for the site, and fastening the domed pear-shaped nest among the slim branches in such a way that they are interwoven in a number of places into its outer structure. The nest is an elongated ball, with a circular entrance on one side at the top; it is constructed of the same material as is commonly used by Smith's Weaver-bird, with the addition of a little vegetable down as lining. The little architects carefully plait their material so as to make the walls perfectly firm, but they nevertheless leave the texture of the completed nest so open that it forms for the young brood a cradle that is airy and filled with light. The external measurements of a typical nest are 125 mm. high, 75 mm. broad and 70 mm. from front to back at the thickest part; the circular opening is 30 mm. in diameter.

Four eggs are laid; typical eggs are green with a zonal band of brown at the larger end and blotches of a less distinct hue scattered over the rest of the shell, but there is much variation. They measure 16 to 18 mm. by 13 mm.

[*Prinia maculosa* (Bodd.)—The Cape Wren-warbler—has not been actually obtained within our limits. It occurs at Peddie, where I met with it in September, 1912; at the same place and time I handled a specimen obtained for me by Rev. D. B. Davies.]

Acrocephalus baeticatus (Vieill.)—The African Reed-warbler—is the only water-loving species commonly met with in the Buffalo Basin. It loves the long vegetation growing in marshy ground and by the sides of the rivers, and it keeps so closely to the shelter of the thick reed-beds and other dense vegetation near the water that it would remain practically undetected did it not itself claim attention by its bold, commanding song. Directed by its notes, we can easily trace its whereabouts and even obtain frequent momentary glimpses of the producer, but seldom can we have the opportunity of watching it for any length of time.

This reed-warbler occurs not only by the marshes and rivers, but also in gardens and fences away from the water. I believe that it is this same species which I have heard at Pirie in thick fences bordering the mealie-lands, and at the mouth of the Buffalo amongst dense undergrowth as well as high up on the slope of the river bank.

The skulking disposition of this species renders it a difficult matter for us to determine whether it is migratory or resident; so far as our observations go, the bird is only known to occur during the summer, from September 14 to March 7, that is, during the period when it betrays its presence by its song.

On 29 October, 1908, before I had as yet handled this bird, I examined on the Mnxesha river a nest which I have no doubt belonged to this species. The cup-shaped nest was suspended between two growing plant-stems and contained two eggs. The owners were extremely wary, reminding me by their cry and actions of the European Sedge-warbler.

Bradypterus sylvaticus (Sund.)—Knysna Reed-warbler. On 17 May, 1912, on my return home, I found among the birds brought in that day by my little hunters a species of *Bradypterus* quite unknown to me. I forwarded it to the Transvaal Museum, where it was determined to be intermediate between *B. sylvaticus* and the Pondoland form recently described by Haagner as *B. pondoensis*. As the specimen links up the two forms and belongs moreover to a species but poorly represented in collections, we must wait till further material is obtained before we can definitely assert the existence of a sub species or sort such out satisfactorily. The specimen, a female, is now in the Albany Museum. No information could be obtained regarding the habits of the bird, and no second specimen was ever brought to me.

Hemipteryx minuta Gunning—Gunning's Tinky. Throughout the wide stretches of open veld occurs abundantly this small species of grass-warbler, which, though known from time immemorial to the Kafirs under the name of *unonqane* and in recent years under the name of *iqqaza*, remained unknown to science till described by Dr. Gunning from Transvaal specimens in 1909. On the open veld below the Pirie forest, Gunning's Tinky is abundant, and was brought to me in numbers by the boys.

Few birds can equal the tinky in hardiness. Tiny ball of feathers though he is, he lives on the open veld, where there is sometimes but scanty vegetation, and in this exposed situation he defies all weathers. As the horseman careers across the treeless country, he always casts a pitying glance on the hardy little tinky that flutters up from his horse's feet and flies a few yards over the short grass to settle again, or, as he watches the little fellow mount in the air and hover around, continually beating his wings and clicking his hardest, he repeats to himself, if he knows it, the Kafir women's song to their trusty confidant:—

"Lead me, nonqane, up to heaven,
That I may find the man of the single heart,
For the men of this land are all double-hearted."

The tinky is a favourite with everybody, even with the little Kafir herd-boys, who are lost in wonder at his power of mounting in the sky until he disappears from sight; yet this respect for his powers does not prevent his figuring as the commonest item on these same herd-boys' menu-card. In spite of the persistent raids made upon this species, however, and especially on the nesting females, the bird does not appear to diminish in numbers. The male is recognised by his inky-black mouth. Two engaged in fighting were caught by a boy and brought to me; one was an adult male, and the other a young male.

The clappering noise made by the tinky—best represented by the "q" click in Kafir—is one of the best known sounds of the open, treeless veld; it is most noticeable from the beginning of October to the end of March, though it is also occasionally heard in the winter months.

Nesting begins in October and continues till March; my earliest and latest dates for nests with their complements of eggs being respectively November 4th and March 13th. In my note-books are entered thirty-six nests, most of which were brought in by my little hunters. The nest is cunningly concealed in a tuft of grass in the ground. In the chosen hole a slight foundation of short and loose material may be placed; this material varies from the very slenderest stems to odd blades of six millimetres in breadth. On this is built the ball-shaped nest, sixty to seventy millimetres in extreme diameter, that is, from exterior wall to exterior wall. The outer shell of the ball consists of grassy material varying from stems of the thickness of medium thread to blades four millimetres in cross-measurement, all loosely put together and sparsely used. Within this is an inner film constructed even more sparingly and loosely of thin wiry stems up to strips of grass nearly two mm. in diameter; on the inner side of this frail shell is attached a silvery lining of goat's hair with a little wool, the white cottony heads of some veld plant and an odd feather or two. Owing to the slim nature of the framework, the nest generally goes to pieces when removed from its natural position. In those nests seen by me *in situ* the tiny entrance-hole has been at the side of the nest; in one nest, measured in position, the entrance hole was 21 mm. broad by 28 mm. high. On account of the position of the entrance-hole, Roberts has removed Gunning's Tinky to the genus *Cisticola*.

The complement of eggs is generally four, though sometimes three only, and occasionally five are laid. The eggs vary greatly in colour, though those in the same nest are generally coloured alike. A common type at Pirie is faint greenish-white in ground colour with minute freckles of purplish-grey all over and a zone of the same colour at the larger end, but the ground colour may be pure white or of varying shades of blue and green; the markings, in a few cases practically obsolete, vary in other specimens from minute dots to large spots and rarely, blotches of all shades of brown.

In a large series of eggs from Pirie the measurements vary from 17 mm. by 12 mm. to 13 mm. by 10 mm., the average being 15 mm. by 12 mm.

The evidence derived from the snaring of the sitting bird indicates that incubation is carried out wholly by the female.

Cisticola fulvicapilla (Vieill.)—Tawny-headed Grass-warbler.—From its abundance and its tameness, the little *Neddiky* ranks among our best-known birds. Its natural home is among the rough vegetation bordering streams, forests, and cultivated land; and, wherever long grass is found intermingling with scrub, there the Neddiky may be found. In the dense forests a cry is heard which might readily be mistaken for the cry of this bird, but Mr. John Ross tells me that the deceptive cry comes from the Yellow-throated Flycatcher. There is therefore no proof at present of the occurrence of the Neddiky in the heart of the forest belt, but it reappears above the forest line. It has long since adapted itself to the changes brought about by civilisation, and creeps fearlessly along the fences and through the vegetable plots around our homes.

Its most characteristic feature is its monotonous *weep*. This call, which is variously rendered in my note-books as *tyilp*, *weelp*, *tyeep* and *ween*, has been very aptly likened by Mr. D. Adamson, of Livingstonia, to the creaking of an ungreased wheel-barrow. From early morn till after sunset the monotonous sound goes on intermittently, constituting all the year round one of the most familiar voices from the scrubby hillsides. The producer is generally perched on a slight elevation, but may not infrequently defy detection.

This call may be preceded by a sound like *ts*, lengthening the cry to *ts-ween*. This *ts* seems to be the ordinary call-note, most suitably represented by the Kafir *c* click. From this call is derived the Kafir name of *necde*, which has in its turn given birth to the colonial *Neddiky*. When the birds are wildly excited over the approach of an intruder to their young, they give vent to their alarm in a cry resembling the Kafir *q* click, which is sometimes so hurriedly repeated as to produce a rattle suggesting that of the European wren.

In feeding on the ground the bird hops, and as it hunts it clicks to itself and jerks its tail in the spasmodic fashion characteristic of its tribe and described under *C. aberrans*. Though essentially a grass-bird, the Neddiky often flies up into a comparatively high tree, and, after surveying its surroundings from the lofty outpost, descends again to the grass.

The nesting-season lasts from October to March, the earliest eggs at Pirie having been brought in on October 28, and the young having been seen in the nests as late as March 16. The nest is built among grass, sometimes close to the ground, at other times a little above it in a place where the grass is strengthened by shrubs. It is a loose domed structure, of broad plant-blades externally, with finer material in the inner layers. A felted mass of white vegetable down lines the entire inner surface and renders the structure compact in spite of its loose appearance. Between the loose grasses and the white downy lining there may be a sparing layer of plant fibres. The eggs, three or four in number, vary in ground colour from white to greenish-white or greenish-blue; they are freckled and spotted all over, so closely at the larger end as to form in some cases a zonal band, with varying shades of brown, and measure 15 x 12 mm.

Cisticola aberrans (A. Smith)—Smith's Grass-warbler—is much less numerous than its small relative, the Neddiky, but is widely distributed. It occurs in the shore scrub at East London, and is common both below and above the forest at Pirie. In some of the upland districts it is our commonest grass-warbler. It frequents scrubby hillsides, the long vegetation about marshy ground, the tall grass bordering the forests and the rough borders of cultivated lands. In habits as well as in appearance this species is a large edition of the Neddiky; it moves restlessly about among the long grass and scrub, carrying its long tail erect and flirting it in a fashion very characteristic of this group. In a series of successive spasmodic jerks it moves its tail a considerable way to the right, then by a similar succession of jerks it brings it back to the normal position and moves it on to the left, making its tail go like a jerky pendulum.

Some of its cries closely resemble those of the Neddiky, especially its alarm *qu,qu,qu,qu* resembling the Kafir *q* click, which moreover under special excitement is run into a trill. This species also utters a drawn-out *peep,* which becomes at times a sharper and bolder *pweep,* and corresponds to the *weep* of the Neddiky. I have not had in this species a favourable opportunity for noting the period of its cries.

Nesting continues from the latter part of November to the end of March. The earliest eggs, in which incubation had begun, were brought in at Pirie on December 6; and the latest, on the point of hatching, on March 23. The nest, a loose ball with a circular opening near the top, is constructed externally of dry blades of plants, up to eleven millimetres broad; within this loose outer shell is a more compact portion formed in different cases of the fine flowering heads of *Galopina*, wiry plant stems, slender lichens, with a few broad blades of grass. The lining is a compact layer of beautiful white vegetable down.

The eggs, three or four in number, are faint bluish-white or greenish-blue, dotted all over with dark-brown spots of varying hue, most thickly at the larger end where some violet blotches may be present and where the markings sometimes tend to form a zone. They measure 17 x 13 mm.

Cisticola terrestris (A. Smith)—The Wren Grass-warbler—was first obtained in our area by Trevelyan, and recorded by Sharpe as *Cisticola cursitans*. In September, 1908, Pym obtained a specimen at Breidbach, near King Williamstown. In spite of long and careful watching, I failed to discover with certainty any haunt near Pirie, and I never handled a specimen during my stay there.

Cisticola natalensis (A. Smith)—The Natal Grass-warbler—reaches the southern limit of its range in the Buffalo Basin. A young bird, fledged, was brought by a boy on 19 December, 1911, and, as it completely puzzled me, it was forwarded to the Transvaal Museum and there identified. This is the only known local record, yet it is sufficient to show us that this species was nesting that year at Pirie. All my endeavours to find the haunt of this grass-warbler were in vain.

Cisticola tinniens (Licht.)—Levaillant's Grass-warbler—has been known to inhabit our area since Trevelyan's day, but even yet its actual status in the Buffalo Basin has not been determined. The bird is very much rarer than *Cisticola lais,* but cannot be ranked among the really scarce species. Five males and three females —two with nests and eggs—were brought in by the boys during my stay at Pirie; but in the fields I never felt confidently able to discriminate this species without handling it. All the specimens brought to me occurred between the beginning of September and the end of January.

The first nest, with female and four eggs, was obtained on 11 December, 1908, and the second, with female and five eggs, on 19 January, 1912. In the latter case the nest was securely fastened in the fork of a strong "everlasting," at a point where four branches rising erect formed a natural cradle to receive it. The nest was an oval ball, with an elliptically-shaped entrance on one side near the top. The basal portion of the nest consisted of broad blades of grass, measuring up to five millimetres in breath; inside was a receptacle of finer grass stems with their fruiting-heads still attached and at the top some withered masses of fine roots were entangled with the grasses. The nest was lined with beautiful silvery pappus.

Each set of eggs is of a uniform pattern, but the two sets differ conspicuously in their ground colour, illustrating the variety which seems universal in this group. In one set the ground colour is greenish-blue, and in the other whitish; both types are finely freckled with varying shades of brown, forming a more or less distinct zone at the larger end. The average measurement is 16 x 12 mm.

The stomachs of specimens examined at Somerville contained beetles.

Cisticola lais (Finsch & Hartlaub)—The Eastern Grey-backed Grass-warbler—differs from the Knysna form, *C. subruficapilla* (A. Smith) in lacking freckles on the breast. It is an abundant and widespread species in our area, ranging from the shore scrub to the grassy uplands above the forest. It frequents chiefly the long reeds by water-courses and the rough vegetation beside vleis and marshes, but it loves also the borders of the forests and of the cultivated lands, and even seeks its food among the weeds in mealie-fields. On the ground it hops, but it is generally seen on the long grass-stems and bushes; by the riversides it usually settles on the reeds and ascends or descends a reed-stalk indifferently. It is a very noisy species, with a very characteristic trilling cry. This trill, *ti-ri-ree*, is followed by a single note, which may be repeated, and is especially in evidence from September to March. Besides the trill, the birds utter, when toying in the air and at other times, a clicking sound *q*, corresponding to one uttered by both *C. fulvicapilla* and *C. aberrans*. During the breeding-season this species has also a very different song, the period of which I have not succeeded in determining.

Nesting begins in October and continues till February. I have seen fair-sized, though unfeathered, young in the nest on October 29, and have received the eggs up to February 6. The nest containing young was built in the centre of a bush, and was domed like those of its congeners. As it contained young birds, I did not examine it in detail. I was quite amused by the action of the young birds; instead of putting up their heads for food, they hissed on account of my intrusion. Both parents were in attendance, uttering first their trill, then indulging in an excited harsh note, and repeatedly flying over my head and settling alternately on each side of me.

At least twenty-six nests have been brought to me by the boys, but they are generally knocked out of shape, as if they required to be wrenched from their attachments. The nest is an oval ball, whose outer structure is formed of the flat blades of grasses and other plants. A favourite plant is a strongly-scented everlasting. Within this loose outer shell a lining of finer grass and wiry stems may be set in the bottom of the cavity; the whole interior is then lined with white vegetable down obtained apparently from the flowers of everlastings and with a little wool. An undamaged nest measured 104 mm. in extreme height, 65 mm. from back to front and 65 mm. from side to side, all measurements being external. The full clutch of eggs is four.

The eggs taken at Pirie exhibit great variation in colouring, as well as in the amount and the intensity of the markings. Some are unspotted white, others of an unspotted light blue; others again may have their ground-colour of white or varying shades of blue, covered with fine freckles or well-marked spots or blotches of various shades of brown with occasional steel-grey markings. In some cases the markings tend to form a zone at the larger end. The measurements vary from 16 to 18 mm. in length by 12 to 13 mm. in breadth.

Sphenoeacus intermedius (Shelley)—The Eastern Province Grass-bird—bears in Kafir the appropriate name of *itshitshi*, or "The Skulker." This is no doubt the form obtained at East London by Rickard. At Pirie the species is not uncommon, though rarely seen. It lives by preference in the thick rank vegetation bordering the forest, and occurs above the forest as well as below it. It ventures also into the mealie fields and occasionally may be seen perched on a mealie-stalk. When its hiding place is approached too closely, it is not averse to taking to flight; it rises above the level of the grass, and after a flight of twenty or thirty yards, or sometimes much less, it plunges into its ambush again.

On a single occasion, 8 August, 1913, I saw one sitting openly on the top of a bush and singing repeatedly.

Nesting begins at the end of October. Eggs on the point of hatching have been brought to me on November 26. The nest is a deep cup of dried grass, 63 mm. across by 47 mm. deep internally. It is quite an artless structure, formed externally of broad grass-blades with a few dry leaves, and has an inner lining of finer wiry stems with an odd leaf and some rougher material. The eggs, three in number, are white, or, at other times, greyish-white, with a well-defined zonal band of purplish-grey and spots of the same colour suffusing the rest of the shell. They measure 23 by 17 mm.

The young bird, when newly hatched, has the inside of the mouth yellow, with three black spots on the tongue. In the adult, the inside of the mouth is black.

Ecological Notes on the Mountainous Portions of the Herschel District.

By Ivan P. Hepburn, B.A.

Edaphic Factors.

The mountains of the Herschel District reach a height of 9,000 feet, and the higher strata consist of Drakensberg lavas and basalt. The Cave sandstone strata reach a height of between 6,000 and 7,000 feet probably. Strata of blue and red shale occur between the Cave sandstone. At a lower level the red sandstone occurs.

Owing to erosion numerous deep valleys and kloofs run down from the mountains. The level strata of sandstone cause numerous plateaux to be formed, where the sandstone is either exposed, or, as is more usual, covered with alluvial soil of various depths. The usual aspect is a crown of Cave sandstone round the edge of the plateaux, and the escarpments below the crown are strewn with large and small fragments of sandstone. Basaltic and gravelly hills occur, and dolerite dykes intersect the country at the lower levels.

Numerous streams, most of them perennial, drain the mountains. After rains these become torrential.

Owing to overstocking, grass fires and footpaths, numerous dongas have formed in the alluvial deposits on the plateaux and in the valleys. Owing to the first two causes dry gullies have formed rapidly on the mountains, and much rock has been exposed, the alluvial soil having been washed away.

Climatic Factors.

The annual rainfall sometimes is as much as 40 inches, and sometimes falls as low as 23 inches. On the mountains it is probably considerably greater.

The seasons are clearly marked. The winter is cold: frost and snow occurring. The spring is usually windy and dry. The early summer (Dec. and Jan.) is often dry, although thunder and hailstorms are prevalent. The late summer and autumn is the rainy season, soaking rains occuring then.

The north and north-west aspects of the mountains and escarpments are warm and dry, while the south and south-east aspects are cool and damp. The western aspects are exposed to dry warm winds, and the eastern to damp cool winds. The vegetation on the damp side of a mountain is very different from that on the hot dry side.

The humidity of the soil seems to be the chief factor in determining the limits of the plant associations. The humidity being dependent on the altitude or the aspect of the land, and on the nature of the rock and soil, it is convenient to classify the associations according to the topographical factors.

Biotic Factors.

These tend to affect adversely the natural vegetation.

1. Man:—A considerable amount of land in the more level parts of the country is cultivated. The bush in the kloofs is destroyed by axe and fire. The veld was regularly burned in the spring (but this practice is illegal now), consequently the torrential rains in the

early summer did considerable damage to the veld, forming sluits. Footpaths are made, which tend to become sluits rapidly. Now considerable areas of veld are reserved during the late summer and winter, giving the grass a chance to seed.

2. Stock:—The district is overstocked with cattle, sheep and goats, consequently the grass and edible shrubs are kept short and often destroyed, while other plants take their place (usually certain Composites and Labiates). The stock form numerous paths which facilitate the erosion of the soil and destruction of the vegetation.

Increasing Aridity.

There is no doubt that the influence of man (in burning the veld, overstocking the country, destroying the bush) has increased, and is still increasing, the aridity of the country (whether the rainfall has been affected or not). This is very evident on the mountains. Areas that were covered with tussocks of grass are now covered with composites (chiefly of ericoid habit). This can be seen on the Nojigi Range above Majuba Nek, where the dry tussocks of grass may still be seen amongst the much more xerophytic Composites. It is interesting to notice on the top of the peak above Majuba Nek, which is not accessible to stock, grasses are dominant, while on the rest of the mountain top (a narrow plateau of the same height and soil), which is accessible to stock, xerophytic composites and *Passerina* are dominant. It is instructive to observe the Wittebergen Range between Herschel District and Lady Grey; on the Herschel side xerophytic composites are dominant, and on the Lady Grey side of the fence (where the country is not stocked to the same extent) tussock grass is often dominant. The scattered composites do not bind the soil as well as the compact tussocks of grass. Hence in many parts erosion is taking place very rapidly, denuding areas of all the vegetation and exposing the underlying rock.

Veld Formations.

The term Veld Formation is used for the vegetation of the more level portions of the district at the foot of the mountains, consisting usually of plateaux of altitudes of 5,000 to 6,000 feet above the sea level, and of gentle slopes at the bases of the mountains.

The veld is mostly grassland, but owing to overstocking, etc., the grass is in many places being replaced by various shrubs, forming the "Changed Veld Formation." The plateaux are usually covered by fairly shallow gravelly or loamy soil. In the valleys there are often very deep deposits of clay. The strata of rock under the soil of the plateaux are usually Cave sandstone, which seems to retain moisture well. In the valleys the land is often swampy and water-logged in the late summer.

Some of the grasses of the veld are:—

Andropogon appendiculatus.

Elionurus argenteus, often dominant over large areas of the high lying veld, but never in valleys.

Andropogon associations are often dominant on sunny aspects with gravelly soil, these will be dealt with later.

Erianthus capensis, occurs in isolated tufts, and is often seen in cultivated lands where the natives regularly plough round the large tufts. It is used in thatching as a foundation over the reeds. Often it occurs along sluits and water-courses.

Aira caryophyllea is abundant in places.

Anthistiria imberbis, occurs in most grass associations, except in vleis.

Agrostis lachnantha, is often dominant in damp places and depressions.

Eragrostis curvula, often dominant on damp veld.

Eragrostis caesia, dominant on peaty soil over Cave sandstone.

Other veld grasses are *Eragrostis brizoides, Poa binata* (under shade of rocks), *Avenastrum antarcticum, Setaria* sp., etc. *Setaria aurea* occurs in damp places, and often becomes dominant in damp cultivated lands that have been neglected. *Phalaris* sp. occurs on the edge of cultivated lands. *Panicum* sp. (? *minus*) becomes dominant in damp neglected lands. If cut before it ripens it forms good hay. In marshy places *Phragmites communis* occurs.

Veld *Cyperaceae* are common. Among them are *Cyperus compactus, Cyperus marginatus, Carex dregeana.*

Other veld plants: *Aster hispidus,* in gravelly soil; *Cineraria aspera,* on old walls and stony places; *Lithospermum cinereum, Sebaea hymenosepala,* on damp plateaux; *Gladiolus tristis,* usually near streams; *Moraea* sp. (193), common on the plains, and *Moraea setacea;* also *Haplocarpha scaposa, Polygala* (? *hottentotua*), *Polygala hispida, Polygala gymnoclada, Acrotome inflata,* on sandy plains. *Walafrida densiflora,* often very numerous; *Phytolacca heptandra, Pachycarpus dealbatus, Senecio digitalifolius,* on plateaux and damp mountain sides; *Erodium cicutarium, Senecio isatideus, Senecio asperulus, Nemesia foetens, Hypoxis Gerrardi, Androcoymbium* sp., etc. In damp places, especially in the valleys, are found *Malva parviflora, Anchusa capensis, Anchusa riparia, Oenothera speciosa, Epilobium flavescens. Nasturtium fluviatilis* and *Sisymbrium Burchellii* are used as vegetables by the Natives, as also are various *Asclepiadaceae. Gladiolus* (? *psittacinus*) occurs very largely in damp places, amongst reeds and in cultivated lands. In wheatlands it comes into flower after the wheat has been reaped. A feature of the veld, especially on the higher plateaux and exposed plains, is the enormous number of helichrysums. In many places, especially on shallow soil on the plateaux, they are dominant. Most of their species have not been determined yet, but amongst them are *Helichrysum subglomeratum, H. rugulosum, H. callicomum, H. ericaefolium.* On the damp clay soil of the valleys *Curculigo plicata* occurs.

To summarize: the veld is chiefly grassland. Amongst the other plants one finds many with Xerophytic modifications. A large number have very hairy leaves. such as the helichrysums, on which account the *Helichrysum* associations have a whitish blue appearance. Plants of an ericoid habit occur largely. Among them are *Selago sp., Lightfootia sp., Ifloga polycnemoides,* etc. There are numerous tuberous plants, such as *Dicoma anomala, Ipomoea ovata,* various *Asclepiadaceae,* etc.

Succulents are very rare, the only ones on the veld being probably a few species of *Mesembrianthemum* and *Crassula.* In winter the weather is cold and usually dry, and most of the aerial organs of the grasses and other plants die down. Deciduous plants are very rare, but some species of *Rhus* shed their leaves. In *Nasturtium, Salvia* and other plants, lateral shoots sprout from the underground organs in June or July, and form rosettes of leaves close to the ground, the inflorescences spring up in summer. There are not many annuals except in the Changed Veld, in cultivated or denuded soil. Some of the plants are evergreens and even flower through the winter. A species of *Androcymbium* is one of the earliest spring flowers. Later on numbers of flowers of *Brunsvigia sp.* appear. *Moraea* flower about the same time, and the orchids and gladioluses a little later—in January or February. Most of the Dicotyledons flower through the summer.

The veld in amongst the mountains, being damper, more shady and more protected than the open veld, has some additional species, including heaths. Some of the plants of this region are *Erica sp.* (Alb. Mus. 303), which often covers considerable areas. *Erica sp* (146), *Erica alopecurus, Dierama pendula,* and various gladioluses *Selago Galpinii* is in places very abundant. Among the grasses *Eragrostis caesia* and *Eragrostis brizoides* are common. *Sebaea hymenosepala* occurs in the grassland.

Andropogon Formation.

This formation occurs on gravelly and rocky kopjes and slopes with a northern or western aspect. *Andropogon hirtus* is dominant . It is often seen in veld preserved for the winter, and grows about two or three feet high. It is very largely used by the natives for thatch. Associated with it is *Andropogon Nardus.* On river banks and in depressions, where this formation occurs, one usually finds *Cymbopogon dregeanus* dominant. This is a tall grass four or five feet high and is also used for thatch. Among the associated plants of the Andropogon Formation are *Polygala* (*? hottentotta*), *Anthospermum pumilum, Ipomoea ovata, Convolvulus capensis, Mahernia parviflora.*

Various.

In the dongas in the veld it is usual to find associations of *Juncus* (*? glaucus*) and *Carex Hepburni* Schönl. n.sp.

On shallow dry soils on sandstone one finds *Wahlenbergia sp., Oldenlandia amatymbica, Euphorbia sp., Muraltia* (probably *M. divaricata*), *Selago Galpinii, Helichrysum spp.,* etc. These are all xerophytic, ericoid, or with sparse narrow leaves, or hairy leaves.

In the vleis on the veld one sometimes finds various *Cyperaceae, Phragmites communis, Veronica anagallis* and *Crassula vaileantii* occur in stagnant water or shallow streams. *Scirpus* (near *S. cernuus* and *S. trachyspermus*) occurs in damp places and oozes. *Carex Hepburnii* is dominant in some vleis and damp places as in the Bensoncale valley. *Mentha aquatica* and *Ranunculus pinnatus* occur in damp places. *Oxalis* (*? Smithii,* var. *angustiloba*) often occurs under the *Mentha. Potamogeton pusillus* occurs in shallow water.

Changed Veld.

Chiefly because of overstocking large areas of grassland are becoming changed. The grasses are being replaced by various annual and perennial shrubs. When such an area is protected from stock the grass gradually becomes dominant again. On large tracts of Changed Veld *Salvia stenophylla* is dominant, and sometimes *Senecio paniculatus*. These two species occur also on changed areas of the mountains to a height of about 7,000 feet. *Senecio asperulus* occurs largely on changed veld. Goats eat its flower heads, and it is usual to find whole tracts of it with all the flower heads eaten off and the bare stalks standing. *Salvia stenophylla*, which contains a pungent oil, is not eaten by anything, and is consequently gaining ground. *Conyza podocephalus* occurs often in depressions. *Lasiospermum radiatum* is sometimes dominant. *Cynodon dactylon* occurs largely on changed veld, and is often dominant. On the lower plains *Moraea sp.* is often very abundant where *Cynodon dactylon* is dominant. *Aster muricatus, Ajuga ophrydis, Cerastium capense, Stachys aethiopica* and many other plants including weeds of cultivation occur on the changed veld.

Mountain Formations.

Rocky Sandstone Slopes.

This heading includes all the rocky slopes in the Cave Sandstone (including lower portions of mountain sides, escarpments of plateaux, sides of kloofs and rocky kopjes). There is a great difference between the vegetation of sunny and of shady slopes or roughly between that of north-western and south-eastern aspects.

The sunny slopes, *i.e.*, those with N. or N.W. aspects, are usually occupied by the Andropogon Formation, with the addition of such plants as *Rhus erosa, Rhamnus prinoides, Asparagus denudus*, (which become entangled in the wool of sheep), *Haplocarpha scaposa, Schistostephium crataegifolium, Nidorella* (? *polysepala*), *Cineraria aspera, Watsonia angusta* (in rock crevices), *Aloe saponaria, Mahernia parviflora* and *Mahernia erodioides,* a succulent *Euphorbia*. *Stachys aethiopica*, *Sutera pinnatifida*, *Herniaria hirsuta*, *Argyrolobium candicans*, *Rynchosia glandulosa*, *Indigofera stricta*, *Gnidia sp.* *Lightfootia sp.*, *Helichrysum rugulosum*, *H. subglomeratum*, *H. setosum*, *Lotononis cytisoides*, *Lasiopermum radiatum*, *Cineraria radiata* and *C. lobata*, *Conyza podocephala*, *Salvia repens* and *Salvia sp.* (?*Woodii*), *Clematis brachiata* (clambering over the rocks), *Cussonia sp.* (growing in rock crevices), *Anthospermum pumilum*, *Pelargonium ranunculophyllum*, *Melasma orobanchoides*, *Ipomoea sp.* (? *crassipes*), *Eriocephalus punctulatus*, *Rhus dentata* (usually in crevices), *Peucedanum capense*, *Dolichos angustifolius*, *Myrsine africana* (common in rock crevices), *Royena hirsuta*, *Melothria punctata*, *Crassula platyphylla*, *Cotyledon orbiculata*, *Asclepias gibba*, *Osteospermum moniliferum*, *Tristachya leucothrix*, *Brachycorythis virginea* and rarely *Lasiosiphon sp.* (near *L. meisnerianus*. Where the soil is gravelly the following plants are found in addition to the grass:—

Aster hispidus,
Dicoma anomala,
Relhania n.sp.,
Androcymbium sp. (near *Androcymbium leucanthum*),
Scabiosa columbaria,
Ajuga ophrydis,
Stoebe cinerea,
Gladiolus edulis,
Striga Thunbergii (a parasite on grass roots),
Lactuca capensis, etc.

Shady Slopes with S. or S.E. Aspect.

Shady slopes with S. or S.E. aspect:—

Often on shady slopes or on sides of Kloof bush and scrub occur. These will be dealt with under the heading Eastern Scrub. Otherwise grass is usually dominant. Among the grasses are *Poa binata*, *Arenastrum antarcticum*, *Andropogon appendiculatus*, *Aira caryophyllea*, etc.

Other plants are:—*Artemisia afra*, *Clutytia pulchella*, *Myosotis afropalustris*, and *Myosotis graminifolia*, *Sebaea macrophylla* and *Sebaea hymenosepala*, *Hesperan-*

tha sp., *Sutherlandia frutescens*, *Dierama pendula*, *Gladiolus sp.* (*? psittacinus*), *Gladiolus sp.* (268 Alb. Mus.), *Moraea setacea* and *Moraea spathacea*, *Scleria holcoides*, *Dispersis sp.* (*? Bolusiana*), *Disa parviflora*, *Ornithogalum sp.* (near *O. subulatum*), *Psammotropha androsacea*, *Urginea sp.* (near *U. Natalensis*), in rock crevices. *Anthericum MacOwani*, *Scilla sp.* (*? S. lanceaefolia*), *Lobelia erinus* and *L. Preslii*, *Wahlenbergia sp.*, *Pimpinella cordata*, *Anthriscus sylvestris*, *Micromeria biflora*, *Manulea paniculata*, *Selago Galpinii* (which occurs to an altitude of about 7,000 ft.),*Silene Burchellii*, *Ranunculus plebeius*, *Thalictrum minus*, *Galium rotundifolium*, *Lotononis cytisoides*, *Valeriana capense*, *Erodium cicutarium*, *Helichrysum sp.* (*? adenocarpum*), *H. callicomum*, *H. odoratissimum*, *Phygelius capensis*, *Stoebe cinerea*, *Disperis Tysoni*, *Dianthus scaber*, *Anemone Fanniniae*, *Pelargonium grossularioides*, *Mimulus gracilis*, *Tragopogon parrifolius Metalasia sp.* (*M. Stricta*), on shallow soil, *Erica* (158), *Ericinella* (121), *Geranium canescens*, *Geranium ornithopodum*, *Psammotropha androsacea*, *Brachycorythis virginea*, *Harveya speciosa*, *Tulbaghia alliacea*, *Kniphofia Nelsonii*, *Agrimonia eupatoria*, *Alepidea ciliaris*, *Cenia turbinata*, *Crassula filamentosa* (in great abundance under the shade of other plants), *Richardia africana* and *Cyrtanthus sp.* (203), in damp places.

On damp peaty soil on sandstone a Sclerophyllous formation occurs, consisting of *Restio sp.* (*? schoenoides*), *Passerina sp.* (*? ericoides*), *Ficinia sp.*, *Erica sp.* (303), *Ericinella sp.* (121), *Cliffortia sp.* (near *C. juniperina*).

On the other sides of the damper kloofs among the mountains one finds *Helichrysum declinatum*, *Harveya purpurea*, *Crassula rubescens*, *Disa MacOwani*, *Disa cornuta*, *Disa Cooperi*, *Disa porrecta*, *Disa chrysostachya*, *Schizoglossum hamatum*,*Harveya speciosa*, *Epilobium flavescens*, *Rubia petiolaris*, *Hebenstreitia integrifolia*. In very damp and shady places *Lycopodium gnidiodes* occurs. On the rocks *Selaginella rupestris* forms cushions. Ferns are numerous.

Eastern Scrub.

This occurs in kloofs and shady slopes not higher than 7,000 feet.

On the lower edge of the formation *Cluytia sp.* (*? natalensis*) often occurs. On fairly dry gravelly situations *Myrsine africana* is often dominant. Sometimes *Rhus sp.* (*? mucronata*) is dominant. Other plants usually associated in Eastern Scrub are:—*Rhus dentata, Rhus erosa, Asparagus stellatus, Asparagus medeoloides, Heteromorpha arborescens, Phygelius capensis* (near streams), *Royena hirsuta, Myrica aethiopica, Malvastrum sp., Kiggelaria Dregeana, Rhamnus prinoides, Rubus Ludwigii, Rubus rigidus, Printzia pyrifolia, Cussonia sp., Clematis brachiata.*

In the undergrowth the following occur:—*Richardia africana, Geranium Harveyi, Lobelia Preslii, Myosotis afropalustris, Anthriscus sylvestris, Rubia petiolaris, Thalictrum minus, Cephalaria sp., Schizoglossum hamatum, Scilla sp.* (*? ovatifolia*), and ferns. On the edges of the formation on dry rocky soil *Cliffortia linearifolia* often occurs. On fairly dry mountain sides the Eastern Scrub formation gives place to the *Leucosidea sericea* formation, especially at higher altitudes. On the damp side of mountain kloofs sometimes *Myrica sp.* (No. 333) is dominant.

Formations at Higher Altitudes than the Cave Sandstones.

The rock consists of Drakensberg lava and basalt. *Leucosidea sericea* occurs on mountain sides and especially in kloofs. On damp shady slopes dense thickets of *Arundinaria tesselata* occur. Fairly damp high plateau and mountain sides are covered with tussocks of grass. In the tussock grass area *Festuca scabra* is dominant. On dry or exposed or shallow gravelly soil plants of ericoid habit are dominant. Thus on the mountains there appear to be roughly four formations:—(1)

Leucosidea sericea, in the kloofs and other suitable places. (2) The mesophytic *Arundinaria tesselata* formation. (3) The less mesophytic tussock grass formation. (4) The xerophytic ericoid shrub formation. This last formation often occurs on the lower slopes of the mountains in the Cave Sandstone Area.

Among the tussocks of *Festuca scabra* the following occur:—*Elionurus argenteus, Anthistiria imberbis, Ornithogalum sp., Albuca sp., Erica frigida, Helichrysum elegantissimum, Helichrysum trilineatum, Helichrysum capillaceum* and numerous other helichrysums. *Xysmalobium undulatum, Myosotis graminifolia, Cenia sp.,* etc. At a somewhat lower altitude *Helichrysum anomalum* becomes sub-dominant and occasionally *MacOwania pulvinaris* occurs. Other mountain grasses are *Pentaschistis basutorum, Danthonia MacOwanii, Fingerhuthia sesleriaeformis, Bromus sp., Harpechloa capensis, Melica racemosa, Setaria perennis, Eragrostis curvula,* etc. Among the alpine *Cyperaceae* are *Ficinia gracilis, Carex clavata, Carex vulpina, Scirpus setaceus, Cyperus rupestris, Tetraria sp.*

Mountain vlei plants (altitude about 9,000 feet):—On shallow wet soil on mountain tops *Crassula Galpinii* occurs. *Sebaea* (either *Marlothii* or a closely allied species) occurs on the edge of the streams. In the mountain springs and vleis the following occur:—*Venidium sp.* (145), *Geum capense, Athrixia fontana, Kniphofia sp.,* etc. *Moraea sp.* (near *M. spathacea* No. 289) occurs on damp slopes and depressions. *Juncus Dregeanus* and *Juncus rostratus,* also *Euphorbia sp.* (No. 104) and *Cyrtanthus sp.* occur along mountain streams.

Where the shrubs of ericoid habit occur *Chrysocoma tenuifolia* is usually dominant on mountain sides. It often spreads down to the veld at the foot of the mountains, where it is associated with *Aster filifolius,* which sometimes is dominant on very stony soil. Associated with *Chrysocoma tenuifolia* one often finds *Selago Galpinii* (at lower altitudes), *Passerina sp.* (*? ericoides*), *Rel-*

hania sp. (No. 152), which is sometimes dominant on very dry places and at high altitudes. Under the shrubs *Helichrysum capillaceum* occurs, also *Crassula filamentosa*, while in damp places *Oxalis sp.* (*? Smithii*) is abundant. Associated plants are *Polygala rarifolia*. *Cotyledon orbiculata, Hyobanche rubra, Melasma orobanchoides, Agrostis lachnantha, Nemesia Flanagani*, n.sp. (No. 54), *Cerastium capense, Silene Burchelii, Lessertia flexuosa, Euryops lateriflorus*. Other mountain plants are:—*Athrixia angustissima, Hypoxis rigidula, Alepidea ciliaris, Helichrysum erosum, Senecio digitalifolius, Nidorella auriculata, Schizoglossum linifolium, Dierama pendula, Hebenstreitia comosa*.

In the crevices on the precipices the following plants are found:—*Crassula papillosa, Crassula filamentosa, Crassula basutica, Crassula rubescens*, various species of *Mesembrianthemum, Ficinia sp., Disperis sp.* (*? Bolusiana*), *Lobelia erinus, Zaluzianskia alpestris, Eucomis sp., Galtonia sp.* (*? princeps*), various *Nemesias, Heliophila sp., Ornithogalum sp., Oxalis sp.*, etc.

Where the mountains have been overstocked and the vegetation frequently burned, *Leucosidea sericea* and *Arundinaria tesselata* have been destroyed, and the tussocks of grass are rapidly being replaced by *Chrysocoma tenuifolia, Salvia repens, Senecio paniculatus, Senecio asperulus*, etc. Most of these plants are useless as food for stock, and so the value of the mountain veld is deteriorating.

A List of Some of the Ferns.

Adiantum capillus-veneris, Asplenium monanthemum, A. sp. (near *A. trichomanes*), *A. praemorsum, A. sp.* (*? lunulatum*), *A. Kraussii, Blechnum australis, Cheilanthus hirta, Dryopteris athamantica, D. elongata, Mohria caffrorum, Nothochlaena Eckloniana, Pellaea quadripinnata, Polystichum pungens, Polypodium lanceolatum, P. vulgare, Pteris cretica*.

CULTIVATION.

Very large areas are cultivated by the Natives. In the low-lying areas, river valleys, etc., mealies and Kafir corn are largely grown. On higher land wheat and oats do very well. Pumpkins, potatoes and small quantities of beans, peas, and tobacco are grown. Most stone fruits, especially peaches, do very well, as also do pears, quinces, etc. In some parts of the district towards the Orange River prickly pear is gaining a hold. Poplars, Willows and Pines do well. On the mountainous portions of the district pine plantations would probably do very well, and would be beneficial in checking erosion. The formation of numerous deep dongas and gullies is certainly detracting from the agricultural possibilities of the district. No attempt is being made to check their formation. The soil must be very fertile, for the Natives reap good crops year after year without manuring the soil at all. Untimely frosts, the dry period in spring and hail storms, which are prevalent when the wheat is ripening, do considerable damage.

Among the weeds of cultivation are:—*Erodium cicutarium*, *Acrotome inflata* (in sandy soil), *Oxalis sp.* (*? Smithii*), *Malva parviflora*, *Chenopodium murale*, *Roubieva multifida*, *Rumex acetosella*, *Hibiscus trionum*, *Convolvulus ulosepalus*, *C. sp.* (*? arvensis*), *Rumex nepalensis*, *Gnaphalium sp.* (*? luteo-album*), *Polygonum aviculare*. *Herniaria hirsuta*, *Solanum nigrum*, *Bidens* sp., *Panicum sp.* (*? minus*), *Setaria aurea*.

This account of the flora of Herschel District is not complete. I could not make a complete collection owing to lack of time, and some of the specimens have not yet been determined. For the names of the plants mentioned I am indebted to Dr. S. Schönland, of Rhodes University College, and to the Albany Museum, Grahamstown.

Bird Life in the Drakensberg, Natal and Basutoland.

By R. E. Symons.

Anyone interested in ornithology visiting the Drakensberg for the first time, will probably remark on the apparent scarcity of bird life. However, those species which do come to his notice will prove profoundly interesting. There is no doubt that the variety of birds in the mountains is not great, and can in no way compare in point of numbers and beauty, with the birds of Zululand or the coast belt of Natal, but some very rare species are to be found, especially on the Basutoland side of the mountains.

During nine years spent in the Drakensberg, as Game Conservator in charge of the Giant's Castle Game Reserve, the writer has had ample time and opportunity for studying, and making notes on, the avifauna of the district, especially as a great part of the time was spent camped in the Mountains, either in Natal or in Basutoland. It is intended therefore, in this article to give a list of the birds met with by the writer during his residence at Giant's Castle, from 1906 to 1916. The locality to be dealt with, will include the Game Reserve, which comprises some fifty thousand acres, lying along the slopes of the mountains, between Giant's Castle and Champagne Castle, the farm immediately adjoining the Reserve, and the Sanqebetu and Mkhotlong rivers in Basutoland. The Sanqebetu River rises on the Natal-Basutoland border at Bushman's Pass, and joins the Mkhotlong River which rises at Giant's Castle, and is a tributary of the Orange, the junction of these two rivers being about forty miles from the Natal border.

One of the most interesting places to visit is the Sanqebetu Valley in Basutoland, which is exceedingly well stocked with bird life, and it was here that the writer was fortunate enough to discover a new species of siskin, which was described by Mr. Austin Roberts of the Transvaal Museum. There are probably several other undescribed species in this valley, but owing to the exceedingly rough nature of the country it is not always easy to procure specimens, unless they are very common as in the case of the siskin, which is very plentiful indeed.

The order and nomenclature is from Haagner and Gunning's Check List of the Birds of South Africa, and the writer trusts that the notes will prove of some interest to ornithologists, especially those who have had no opportunity of studying the bird life of the Drakensberg Mountains.

Phalacrocorax lucidus (Licht)—South African Cormorant. Very common in the Mkhotlong Valley, Basutoland. In September, 1914, while staying at the Mkhotlong Police Camp, the writer saw a large number, some of which were nesting on most inaccessible krantzes at the junction of the Mkhotlong and Orange rivers. Some of the nests contained almost fully fledged young, so the eggs were probably laid about June or July. The nests appeared to be built of sticks, and were placed on ledges of the krantz very high up, so that it would be practically impossible to get at them, and even with the aid of a rope from the top it would be a difficult proposition. This cormorant is not all common in the Game Reserve, only one specimen having been obtained there. Solitary birds were seen on several other occasions; probably visitors from over the mountain.

Anas sparsa (A. Sm.) Eyt.—Black Duck. Found on both sides of the Drakensberg, but by no means common; young birds have been seen in the Game Reserve. A nest was once found just after the eggs had hatched, in August, which was quite close to the Game Lodge.

Chenalopex aegyptiacus (Linn.)—Egyptian Goose. Not at all common, but occasionally seen on the Bushman's River, in the Game Reserve. Fairly common on the Mkhotlong River, especially near its junction with the Orange.

Lapwings, Plovers, Stilts, Thickknees and Snipe were never met with either in Natal or Basutoland. A species of Sandpiper was, however, fairly common, especially on the Bushman's River, probably *Tringoides hypoleucos;* a specimen was never obtained.

Sarothrura lineata (Sw.)—Streaked Crake. Fairly common in the Game Reserve, where a specimen was once caught alive. I have not met with it in Basutoland.

Turnix lepurana (A. Sm.)—Kurrichane Button Quail. A fairly common species in the Game Reserve, Natal.

Geronticus calvus (Bodd)—Bald Ibis. Very common in the Mkhotlong Valley, Basutoland, where they were found nesting during September, 1914, on the krantzes at the junction of the Mkhotlong and Orange. They have not been seen in the Game Reserve, but on one of the adjoining farms, about five miles from the Reserve, numbers of them have nested in a krantz for many years in succession. The eggs may be looked for in late August, September and early October.

Theristicus hagedash (Lath.)—Green or Hadadah Ibis. Not at all common on the Natal side of the Drakens berg; in fact, they were very rarely seen except during the breeding season. A nest containing two eggs was found near Giant's Castle, in November, 1915. I have not seen this bird in Basutoland.

Ciconia nigra—Black Stork. Fairly common in Natal and Basutoland, where they breed. The eggs are laid during August and September.

Scopus umbretta—Hammerhead. Very rarely seen in the mountains; a solitary individual was sometimes seen hunting for frogs in the stream close to the Game Lodge, Giant's Castle Game Reserve.

Ardea cinerea (Linn.)—Grey Heron. Common in the Game Reserve, especially on the Bushman's River, where they breed, the eggs being laid in August and September.

Columba phaeonota—Rock Pigeon. Very common both in Natal and Basutoland. At the back of Game Lodge, close to the house, there was a small salt lick, where salt was thrown out for the cattle and horses, and numbers of rock pigeons would come down to this every morning, sometimes as many as twenty or thirty together. Two eggs were taken by me in September, but they appear to lay all the year round, as I have also taken eggs in winter.

Turtur senegalensis—Laughing Dove. Very rare, only one specimen seen in the Game Reserve.

Turtur capicola—Cape Turtle Dove. Fairly common in the Game Reserve, but not in Basutoland.

Aplopelia larvata—Cinnamon Dove. Only found in the thick bush on the foothills of the Drakensberg.

Oena capensis—Namaqua Dove. Only twice has this bird been seen by me in the Game Reserve, and on both occasions it was feeding in the cattle kraal at Game Lodge.

Francolinus levaillanti—Cape Red-wing Francolin. Fairly common on the Natal side of the Drakensberg. but not in Basutoland. Eggs may be looked for in November.

Francolinus afer—Grey-winged Francolin. Exceedingly common on both sides of the mountains: these birds breed in October and November.

Coturnix africana—African Quail. Fairly common during the summer months, especially on the Natal side. In December, 1913, and January, 1914, a very large number visited the Game Reserve, and a great many nests were found.

Coturnix delagorguei—Harlequin Quail. Sometimes seen in the Game Reserve during the summer months.

Gyps kolbei—Griffon Vulture. Not at all common; on one occasion while setting traps for jackals at the carcass of an eland several were caught. I have seen a few in Basutoland.

Neophron percnopterus (Linn.)—Egyptian Vulture. I caught one of these vultures in a trap set for jackals at the carcass of an eland; they are by no means common. I have not found a nest.

Serpentarius serpentarius—Secretary Bird. Common on the Natal side of the Drakensberg, but I have not met with it in Basutoland. From one to two eggs are laid during September and October.

Circus ranivorus—South African Harrier. Occasionally seen in the Game Reserve, but not in Basutoland.

Astur tachiro—African Goshawk. Fairly common in the thick bush on the foothills of the Drakensberg. I have taken the eggs in October. This goshawk always lines its nest with green leaves.

Accipiter rufiventris — Red-breasted Sparrow-hawk. Common in all the bushclumps on the Natal side, but, like *Astur tachiro*, is not found in Basutoland. These sparrow-hawks breed in the Game Reserve, and I have found a great many nests, containing from two to three eggs, in the month of October. The nest can be distinguished from that of the preceding species, as it is generally lined with moss, never with green leaves.

Circus maurus—Black Harrier. An occasional visitor. I once shot a specimen, which I sent to the Natal Museum.

Aquila verrauxi—Black Eagle. Common on both sides of the mountain; these birds are exceedingly destructive, and destroy a great deal of game every year, besides baboons, which they appear to be very fond of. I have found several nests on most inaccessible krantzes. In June one of these, which I could see from the top of the cliff, contained two eggs. A female shot by me in the Game Reserve measured over seven feet across the wings from tip to tip; this specimen is now in the Natal Museum. The largest male shot by me measured six feet six inches across.

Buteo jakal—Jackal Buzzard. Exceedingly common in Natal and Basutoland. Although these birds do considerable harm in destroying partridges, they also do a lot of good in killing snakes and other vermin. I once saw a buzzard flying along, with a snake (which was about four feet long) in its mouth. The eggs, two in number, are laid in August to October, the nest being built of sticks on a krantz or in a convenient tree.

Pandion haliaetus—Osprey. Sometimes seen on the Bushman's River, in the Game Reserve, but not met with in Basutoland. I once sent a specimen to the Natal Museum, together with a fair sized trout which it had just killed. I have not found a nest.

Elanus caeruleus—Black-shouldered Kite. By no means common on the Natal side of the Drakensberg; not met with in Basutoland.

Falco biarmicus—South African Lanner. Fairly common in the Game Reserve and in Basutoland. Nests on inaccessible krantzes, and I have not taken the eggs.

Cerchneis rupicola—South African Kestrel. Common in Natal and Basutoland; the nest is built of sticks in a hole or on a ledge of a krantz, three eggs being laid in August or September. I once saw one of these birds swoop down and capture a rock pigeon on the wing.

Cerchneis naumanni—Lesser Kestrel. An occasional visitor.

Bubo maculosus—Spotted Eagle Owl. Fairly common in the Game Reserve, but not met with in Basutoland.

Asio nisuella—Marsh Owl. By no means common on the Natal side of the mountain, and not met with in Basutoland.

Glaucidium perlatum—Pearl-spotted Owlet. I have seen several specimens in the Game Reserve, but have not met with it in Basutoland.

Cuculus solitarius—Red-chested Cuckoo. Very common in the Game Reserve during the summer months; it invariably arrives about the 10th October.

Iynx ruficollis—South African Wryneck. An occasional visitor to the Game Reserve, but not met with in Basutoland.

Geocolaptes olivaceus—Ground Woodpecker. Very common on both sides of the mountain. The eggs, three in number, may be looked for in September and October.

Dendromus notatus—Knysna Woodpecker. Fairly common in the Game Reserve, but not met with in Basutoland.

Coracias garrulus—European Roller. An occasional visitor.

Ceryle maxima—Giant Kingfisher. Common in the Game Reserve, where I have found many nests; they lay from three to four white eggs, which may be looked for in September and October.

Caprimulgus europaeus—European Night-jar. Fairly common in the Game Reserve, but not met with in Basutoland.

Apus melba africanus—White-bellied Swift. Very common on both sides of the Drakensberg, during the summer months.

Apus barbatus—Black Swift. Exceedingly common during the summer months, both in Natal and Basutoland.

Apus caffer—African White-rumped Swift. Common on both sides of the Drakensberg, where they breed, using the nest of *Hirundo cucullata*, the rightful owner being sometimes forcibly ejected. The eggs, two in number and pure white, are laid during November and December.

Riparia fuligula—Rock-martin. Common in Natal and Basutoland. It builds a cup-shaped nest of mud, lined with grass and feathers, under a ledge of a cliff or over hanging rock, and lays from three to four white eggs, spotted with reddish brown. The breeding season is October and November.

Hirundo rustica—European Swallow A summer visitor.

Hirundo cucullata—Larger Stripe-breasted Swallow. Common on both sides of the Drakensberg; eggs may be looked for from October to January.

Muscicapa grisola—Spotted Flycatcher. Fairly common in the bushes on the foothills of the Drakensberg, near Champagne Castle on the Natal side, but not met with in Basutoland. I have not found the nest.

Alseonax adustus—Dusky Flycatcher. I have occasionally met with this flycatcher in the Giant's Castle Game Reserve, but never in Basutoland. I once found a nest built on a cliff about fifteen feet from the ground; it was beautifully constructed of fine grass, fibre and hair, and lined with feathers. It contained three eggs of a pale-greenish blue, covered with rust coloured spots. Eggs are laid during October and November.

Batis capensis—Cape Flycatcher. Common in the bushes on the Natal side of the Drakensberg. They lay from two to three bluish white eggs, which are spotted and blotched with brown. The breeding season is October and November.

Tchitrea paradisea—Paradise Flycatcher. Fairly common in the bush of the Game Reserve; the eggs are laid in October or November.

Pelicinius zeylonus—Bakbakiri Bush Shrike. Very common on both sides of the mountains; its cheery call is one of the familiar sounds of the Drakensberg. The nest is rather difficult to locate, being built in thick scrub. The eggs, three in number, are blue, spotted with brown, and are laid during October and November.

Dryoscopus cubla—Lesser Puff-back Shrike. Common in the bush on the Natal side of the Drakensberg, but not met with in Basutoland.

Lanius collaris—Fiscal Shrike. Never met with in Basutoland, and by no means common in the Game Reserve. The breeding season is August to December.

Heterocorax capensis—African Rook. Very common in the Giant's Castle Game Reserve, where I have found a large number of nests. They lay from three to five eggs, white thickly blotched and spotted with reddish brown. The nest is built in a tree or krantz, and very strongly put together with sticks and grass, with a lining of horsehair and fine grass. These birds are also found on the Basutoland side.

Corvultur albicollis—White-necked Raven. Common on both sides of the Drakensberg. I have not found a nest.

Oriolus larvatus—Black-headed Oriole. Sometimes seen on the Natal side, but never in Basutoland. The breeding season is from October to January.

Buphagus erythrorhynchus—Red-billed Oxpecker. By no means common on either side of the mountain.

Spreo bicolor—Cape Starling. Found on the Natal side of the Drakensberg, but they are not common. The breeding season is from September to January.

Amydrus morio—Redwing Starling. Very common, especially in the Game Reserve, where the breeding season is from October to December. The nest is built of mud and grass-roots, lined with fine grass and horsehair, and is placed on a ledge of rock or in a hole in a krantz; from three to four eggs are laid of a blue colour covered with reddish brown spots and blotches.

Ploceus capensis olivaceus—Olive Weaver. Very common in the Game Reserve, but not met with in Basutoland. From three to four blue eggs are laid during November or December.

Euplectes capensis approximans—Lesser Cape Bishop Bird. Exceedingly common in the Giant's Castle Game Reserve, where I found many nests containing from three to six eggs. The breeding season is from October to January. I have not met with this bird in Basutoland.

Pyromelana orix—Red Bishop Bird. This is by no means a common bird in the Drakensberg, but it may sometimes be seen in the foothills. The breeding season is from October to December.

Colinspasser ardens—Red-collared Widow-bird. Very common in the Giant's Castle Game Reserve, where the breeding season is from October to December.

Diatropura procne—Great-tailed Widow-bird. Common on the Natal side of the Drakensberg, but not met with in Basutoland. The breeding season is from October to December.

Estrilda astrild—Common Waxbill. Fairly common in the Game Reserve, but not met with in Basutoland. The breeding season is from October to January.

Estrilda subflava—Orange-breasted Waxbill. This bird, although not often met with in the Game Reserve, is very common on some of the adjoining farms, especially on the banks of the Bushman's River. It generally takes possession of an old nest of the Red Bishop Bird, and, after lining it afresh, lays from four to seven white eggs.

Estrilda incana—South African Grey Waxbill. Fairly common in the Game Reserve; I have found the nest in the pine trees growing round the Game Reserve Lodge. The breeding season is from November to January.

Ortygospiza polyzona—Quail Finch. Very common in the Game Reserve, but not met with in Basutoland. The breeding season is from December to February. The nest is built of grass close to the ground, and from four to six white eggs form the complement.

Vidua serena—Pin-tailed Widow-bird. Common in the Game Reserve, especially near Game Lodge, where they were often to be seen in the gum trees. I have not met with this bird in Basutoland. The eggs are generally deposited in the nest of *Estrilda astrild*, or in that of *E. subflava*.

Poliospiza gularis—Streaky-headed Seed-eater. Common in the Game Reserve, but not met with in Basutoland. I found a nest in a sugar-bush, on the 17th November, 1915, containing three eggs, which are white, spotted and streaked with dark brown, forming a ring at the large end.

Serinus canicollis—Cape Canary. Very common in the Game Reserve; they nest every year in large numbers in the pine trees round Game Lodge. The breeding season is from October to December.

Serinus flaviventris—Yellow-bellied Seed-eater. I met with these birds in large numbers in the Drakensberg, Basutoland, at an altitude of about 9,000 feet. I have not come across them on the Natal side.

Spinus symonsi—Basutoland Siskin. Very common indeed in the Drakensberg, from the Natal border to the Orange River, down the Sanqebetu and Mkhotlong valleys. These birds are sometimes met with in the Game Reserve, on the foothills. The nest is built in a tuft of grass or shrub growing out of a cliff, is cup-shaped, and is constructed of fine grass, lined with wool and hair; from three to four eggs are laid during the months of November and December, these are white in colour, spotted with dark brown.

Fringillaria capensis—Cape Bunting. Common in the Drankensberg both in Natal and Basutoland, especially in the Sanqebetu Valley, where it breeds in large numbers during the months of October and November. The nest is built of grass and lined with hair or wool, it is found in a tuft of grass, or thick scrub, the eggs being bluish white, speckled with reddish brown. This is a very lively and confiding little bird, and often while camped in the mountains I have watched them hopping round my camp fire in search of food.

Motacilla capensis—Cape Wagtail. Common both in Natal and Basutoland where they have been found nesting during the months of October and November.

Anthus chloris—Yellow-breasted Pipit. Common in the Drakensberg on the Natal side, where I have found many nests. Not met with in Basutoland. Breeding season September to December.

Anthus brachyurus—Short-tailed Pipit. Common in the Game Reserve, where they breed during the months of November and December, the eggs being white, covered with brown spots.

Anthus rufulus cinnamomeus—Tawny Pipit. Fairly common in the Game Reserve. Breeding season from September to December.

Anthus nicholsoni—Nicholson's Pipit. Met with this bird in the Drakensberg of Natal and Basutoland. Breeding season November to December.

Anthus leucophrys—Plain-backed Pipit. Common in the Game Reserve, the breeding season being from October to December.

Macronyx capensis—Cape Longclaw. Common in the Game Reserve. Breeding season October to January.

Pycnonotus barbatus layardi—Black-cap Bulbul. Fairly common in the bush in the Game Reserve, but not met with in Basutoland. Breeding season October to January.

Zosterops virens—Green White-eye. Very common in the Game Reserve, where I have found their nests; they lay three blue eggs, the breeding season being from October to early January.

Cinnyris chalybaeus—Lesser Double-collared Sunbird. Fairly common in the Game Reserve, but not met with in Basutoland. Eggs taken in October and November.

Nectarinia famosa—Malachite Sunbird. One of the commonest birds in the Drakensberg, and the song of the male is a very familiar sound in the bushy kloofs, during spring. I have examined many nests, and the number of eggs laid is generally two, but I have twice found nests containing three eggs. Breeding season from November to February.

Promerops gurneyi—Natal Long-tailed Sugar-bird. This is another very common species in the mountains on the Natal side, especially on the hills round Game Lodge where sugar bush is plentiful. It is a very noisy, restless bird, and its chattering is another very familiar sound in the mountains during early spring, when the sugar bush and sutherlandias are just bursting into flower. I have often heard it calling at night and early in the morning. Breeding season October to December. The nest is cup-shaped, built of twigs and grass, and lined with sugarbush seeds and fine grass; it is invariably placed in a sugarbush tree, from one to two eggs being laid, which are cream coloured, speckled and scratched with dark brown. I have not met with this bird in Basutoland.

Parus afer—Grey Tit. Only one specimen obtained, and that from the Sanqebetu Valley, Basutoland. I do not know when it breeds.

Parisoma plumbeum—Hartlaub's Titbabbler. Another species only met with in the Sanqebetu Valley, Basutoland, but I have not found its nest.

Sphenocacus natalensis—Natal Grass Bird. Very common in the Game Reserve, but not met with in Basutoland. It builds a cup-shaped nest in the middle of a tuft of coarse grass growing on the bank of a river or stream, and lays two white eggs spotted with brown. Breeding season October to December.

Cisticola tinniens—Levaillant's Grass-warbler. Common on the Natal side of the Drakensberg. Breeding season October to January.

Cisticola lugubris—Buff-fronted Grass-warbler. Fairly common in the Game Reserve. Breeding season October to December.

Bradypterus babacculus—Reed-warbler. Common in the Game Reserve. It builds a cup-shaped nest of grass, in thick scrub, and lays from one to two eggs. Breeding season November to December.

Acrocephalus bacticatus—African Reed-warbler. Met with in the Game Reserve and on adjoining farms, but it is not common. It builds a cup-shaped nest of grass, attached to two tall reeds; and lays from two to three eggs, in December or January.

Prinia hypoxantha Saffron-breasted Wren Warbler. Very common in the Game Reserve, where I found many nests containing from three to four eggs, which vary a great deal in colour, some being blue and others white, covered with reddish brown blotches and spots. Breeding season October to December.

Apalis thoracica—Bar-throated Wren Wabler. Common in most of the bush in the Game Reserve, but not met with in Basutoland. Breeding season November and December.

Camaroptera brachyura—Green-backed Bush-wabler. Fairly common in the Game Reserve, but not met with in Basutoland. The eggs are laid in November or December.

Chaetops aurantius—Orange-breasted Rock Jumper. Very common in the Drakensberg, Natal and Basutoland, where its shrill cry is often heard. The nest is built of grass lined with wool and hair, and is very well hidden under a rock or tuft of grass; three white eggs are laid from September to October.

Turdus olivaceus—Cape Thrush. Very common in all the bush in the Game Reserve, but is not found in Basutoland. Breeding season October to December.

Monticola rupestris—Cape Rock Thrush. One of the commonest birds in the Drakensberg, especially in the Game Reserve. Breeding season from October to December, the eggs being white covered with very small reddish brown spots.

Monticola explorator—Sentinel Rock Thrush. This bird is also very common both in Natal and Basutoland. The nest is built on a ledge of rock, of mud and grass roots, lined with fine grass, the usual number of eggs being three which are invariably a uniform blue colour. Breeding season September to November.

Thamnolaea bifasciata—Buff-streaked Chat. Fairly common in the Game Reserve, where it breeds during October and November, the eggs being creamy white covered with reddish brown spots.

Emarginata sinuata—Sickle-winged Chat. Very common in the Sanqebetu Valley, Basutoland, where many nests were found in October and November; from two to three eggs are laid, these are blue covered with brown spots, although some of the eggs examined had no spots.

Saxicola monticola—Mountain Chat. I only met with this bird once and that was at the Mkhotlong Police Camp, Basutoland, where a pair had built their nest in the stable wall. Three eggs are laid in November or December, their colour being blue spotted and blotched with reddish brown.

Pratincola torquatus—*South African Stone Chat.* Common on both sides of the mountain. Breeding season from September to December.

Cossypha caffra—*Cape Robin Chat.* Exceedingly common on both sides of the mountain. Breeding season October to December.

Phoenicurus familiaris—*Familiar Chat.* Common in the Game Reserve, where I have often found it nesting, generally in a hole in a bank or on a ledge of rock. From two to three eggs are laid, these being blue, spotted with reddish brown. Breeding season October to December.

How to Collect, Preserve and Study Lepidopterous Insects in South Africa, Part. II.

By A. J. T. Janse, F.E.S. (Lond.).

(Continued from p. 48, Vol. I., No. 1, May, 1918).

Setting.

Setting requires great care if the best results are to be obtained. Do not be in a hurry and do not lose patience. Be sure that the insect is correctly pinned; if this is not the case the setting must be a failure. Study figures 7 and 8 (Plate II., Vol. I.) carefully, and see that the pin is in the position shown by the dotted lines. Place the insect into the groove in such a way that the roots of the wings on the underside are just on a level with the upper side of the board. Place the first insect at the top of the board, and when it is set, as indicated below, the next moth is placed a little lower down, so that the fore-wings of the second specimen do not overlap the hind wings of the first. Fix a very narrow strip of tracing-cloth with a pin quite near to the edge of the groove, bring it over the one pair of wings so that these come flat on the board and then bring the wings in position with the setting-needle, holding the strip of tracing-cloth with the other hand in such a way that it may be drawn tight at any moment without interfering with the wings when moving them upwards. The use of the setting-needle requires a little practice in order to move the wings forward with it without piercing the wing-membrane with its point. Holding the needle almost perpendicular to the wing against a rather thick vein is the best precaution against making holes, provided the insect is sufficiently fresh or so relaxed that the wings move easily. I find it a good practice to blow against the insect before placing it in the groove; if the wings flap up and down easily, the insect is good for setting, if not, proceed very carefully or relax still more.

The forewing should be drawn up so high that its inner margin is at right angles to the body, the margins of the two wings will thus form a straight line. The hind-wings are drawn up sufficiently to have the costa well covered by the inner margin of the forewing. If the body moves sideways when drawing the wings up, a pin should be put into the peat or pith alongside the body, so as to prevent this. When the two wings are in position, draw the strip of tracing-cloth tight and fix it with another pin. Now proceed with the other pair of wings in the same way, and when the whole is done, as shown in the illustration, fix the broad strips over the wings so that they are quite covered. This last strip is very important, it keeps the dust from the wings, prevents them from slipping back, and keeps the wings beautifully flat, preventing the curling up of the tips, as usually happens with relaxed specimens. The antennæ can next be arranged and held in place by means of a pin with a little piece of paper attached to it; such a pin is also useful if the body points upwards, and a small piece of cotton-wool may hold the body up if it hangs down.

Now set the second specimen and so on until the board is full. Do not forget to place the locality and date label on the board next to the insect, at the same time. The setting-board must be selected according to the size of the body, and the groove has to be a little wider than the body is thick.

There are various other methods for holding the wings in position, some of them are most peculiar, and, as far as I have tried them, all are unsatisfactory in one way or another.

Keep the insects on the boards for at least two weeks, big moths even longer. Near the sea, three weeks will be required in most cases. If the insect is not thoroughly dry when it is taken off the board, the wings are sure to change their position and uniformity, and one of the attractive features of a neat collection is gone. Keeping the insects on the boards for so long is often the cause of the specimens being destroyed by museum-pests of different kinds, about which more will be said later. I find it a good practice to paint all the grooves, the peat, and the edge of the upperside with an alcoholic solution of Mercuric chloride (corrosive sublimate) once or twice, and also to tap the boards upside down on the table before using them and after the insects are taken off. If any injurious insect is hiding in the grooves, it will fall out and may be killed.

A good protection against ants, etc., which try to destroy the specimens when on the boards, is to have a special cupboard for the setting-boards. This cupboard should have many shelves, and, above all, a close-fitting door; mine has a door fitting in the same manner as the lids of my insect boxes, as described further on. The sides of the cupboard should have many openings, or, better still, practically the whole sides should be covered with the finest meshed copper-gauze obtainable. Placing some napthaline on the shelves under the board is also a good thing, but somewhat expensive, as the napthaline evaporates rather quickly.

To prevent introduction of pests into the collection, I find it best to place the insects, as they come from the boards, directly into special boxes, and before closing the boxes to pour in a small quantity of carbon bisulphide; when fitting tight, the box will hold the fumes for a sufficiently long time to kill any living thing that may have been introduced with the specimens. I find this practice the "A.B.C." of keeping collections free from pests

Insect Boxes.

When a number of insects have thus accumulated, they may be assorted and put into their place in the permanent boxes or drawers. In a way the boxes, in which the insects are finally placed, are the most important requirements of the entomologist.

Unfortunately, well-made boxes are very expensive, especially in South Africa, where I doubt whether a good one can be obtained under fifteen shillings. If it is remembered that a hundred boxes do not go a very long way when a general collection is made, I think it is as well to consider from the very outset whether it is not better to confine oneself to one group of insects, instead of taking every insect coming to hand. It is a good plan to begin with as many boxes as one can afford, otherwise the continual re-arranging takes up a lot of time, and never does the specimens any good. One should have at least about fifty boxes ready if it is the intention to continue collecting for some years. There are two types of boxes, the *store box* and the *insect drawer*. The first is a box with a close fitting lid, usually without a glass cover, made of cardboard or wood. The latter is better, I think, if good wood is selected, as it is rather difficult to make it of cardboard in such a way as to render it dust-and insect-proof, two of the first essentials of a good insect box. The only cardboard box known to me as fulfilling these requirements is the "Deyrolle," obtainable from Heynes Mathew in Cape Town at seven shillings for the size 15½ by 10 inches. I do not think

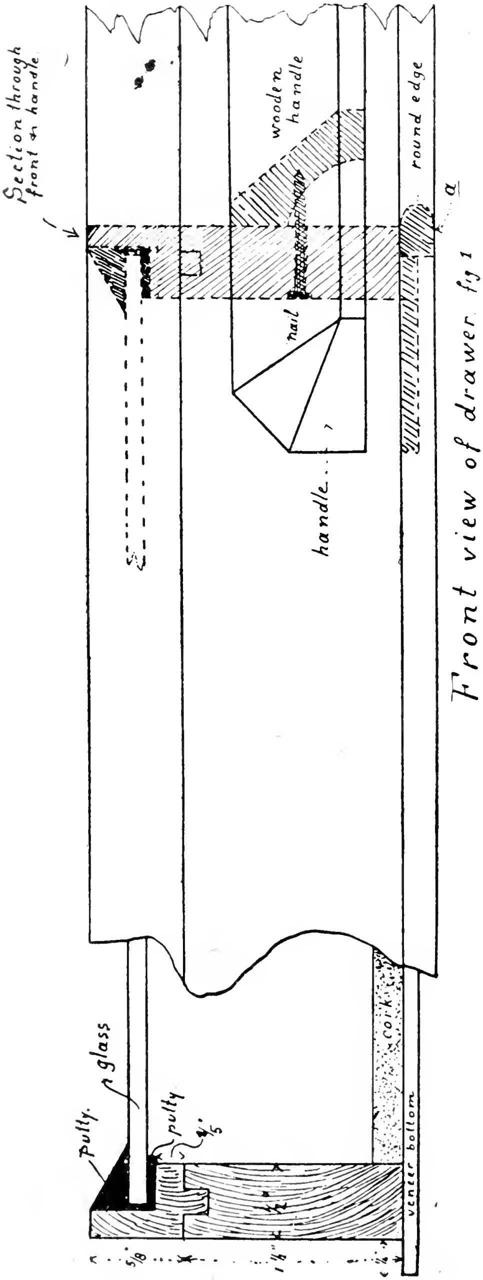

Section through front & handle
wooden handle
round edge
a
nail
handle
Front view of drawer fig 1
putty
glass
putty
1/5
cork
veneer bottom
5/8
1 1/4
1/4

Fig. 1.

these boxes suitable for Lepidoptera, as, in opening them, there is much suction, and the wings of rather small specimens move up and down; this, when often repeated, is sure to cause damage. Most other store boxes have no glass lids, the idea being to shut off all light and thus prevent the fading of colours. This can be accomplished, however, by simply placing one box on top of another and always covering the uppermost with a piece of card board or paper. The drawback of an opaque top is that one has to open the box every time the contents are examined. This refreshes the air inside the box, and some time elapses before the air is again saturated with naphthaline. Moreover, it exposes the insects to all sorts of dangers, breaking, insect-pests, dust, etc. Store boxes are arranged on shelves, sometimes in the way books are placed.

Drawers are so made that they fit in a special cabinet, in which they are arranged in one, two, or more columns, sliding in grooves or on ledges so that each one can be taken out without disturbing the others. In my opinion, every earnest beginner should aim at housing the collection in such drawers.

So as to reduce the re-arranging of the collection to a minimum, the drawers should all be of a standard size and very correctly made, every drawer being interchangeable. Cabinets of various sizes and prices are on the market, but one of a moderately good quality is expensive and usually beyond the average collector. For this reason I think that if the beginner is at all handy and not too well off, he might start from the very beginning by making his own boxes, which will cost about one-fifth

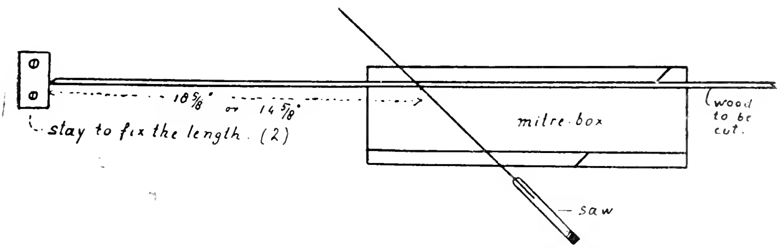
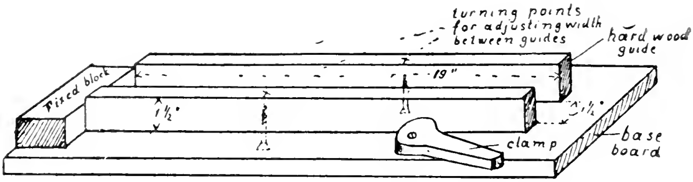


Fig. 2.

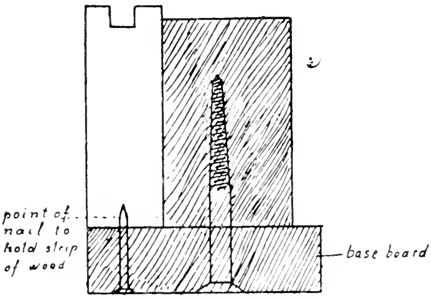
of the price asked. To assist such a beginner I will not only describe the drawer which I found very successful during the twenty years I have used them in South Africa, but I will also give some short description of how to make them, a method which was gradually developed by myself in the making of nearly 500 drawers. Many mistakes, much loss of money, of insects and of time can thus be avoided. The cheapest wood for the sides is american poplar, which answers better than any of the cheaper woods, and if well seasoned is quite satisfactory Pinewood should be avoided, as the resin of this wood combines readily with the fat of some insect-bodies, and thus increases their tendency to greasiness. I think there is no sense in using hardwood, as some writers advocate, it only makes the drawers unnecessarily heavy I always make the bottom of three-ply veneer; formerly I used $\frac{3}{4}$-inch, but my last lots were made of the $\frac{3}{16}$, and answer very well and are much cheaper. The top I cover with well selected *ordinary* glass. My standard size of drawer takes a glass of 14 by 18 inches, as I found this most economical with the size of the veneer. Boxes or drawers should not be too small, as it is as much trouble to make a large as a small box, and, in material, the difference is not so great; yet the boxes should allow of easy handling. One can not have steady fingers for placing an insect into the drawer or examining it with the magnifier if one has to handle boxes of, say, three by two feet, made of one-inch wood. The accompanying illustration will be sufficient to show the details for the structure of the box, especially when following its construction. Obtain first-class, $\frac{1}{2}$-inch thick poplar (american), and have this cut up into strips of 1$\frac{3}{4}$-inch wide for the box itself, and strips of 1-inch wide for the lid. Twelve feet lengths will be most convenient. Next procure a good mitre-box and fix it on the bench. At the correct distance fix a small block of wood in such a way that the $\frac{1}{2}$-inch wood comes well against it when placed in the mitre-box. (Fig. 2.) After first cutting a mitre at the end of the strip, turn it over and then move it along until it stops against the block; if this is at the proper distance, a piece will be cut off just long enough for the long or narrow side of the drawer in making. Every piece will then be of exactly the same length, without any further measuring. The same is done with the narrow strips until all the sides required are finished.

For planing the strips to the correct width, I place three of them in a sort of sledge or guide made of *hardwood* (Fig. 3), and without any marking off I get them all of the same width, and the sides are ready for planing the groove in the bottom part and the tongue on the lid-piece. For the making of these grooves and tongues I use a steel combination plane, which, by simply turning one part of it over, can plane either a groove or a tongue. This plane is much better than the wooden one, it works more correctly and allows of some adjustment. The adjustment of the bits of the plane is very important, as with it the tongue can be made broader or narrower. The tongue should be so that the lid-piece slides freely without wobbling; still it should not be so stiff that the pieces do not come easily apart. The groove should not be deeper than the length of the tongue, if it planes like this, one of the bits must be moved a little upwards. The planing of these grooves presents no difficulty, when one has an easy means of fixing the wood during planing, and for that an apparatus, as illustrated, will be found useful and can easily be made. (Fig. 4.) The points of three nails are pressed into the wood, and these fix the strip of wood into its place. Always hold the plane on what is to become the *outside* of the drawer. Next the rabbet is planed in the lid-pieces to receive the glass, and for this another apparatus is first made. (Fig 5.) Then the two pieces of wood can be fitted together so as to plane the sides, which are to be the outer part of the box. The inside surface of the wood is usually smooth enough from the machine plane. As the ends of the strips are slanting, it will again be necessary to fix the wood firmly with the projecting nailpoints. (Fig



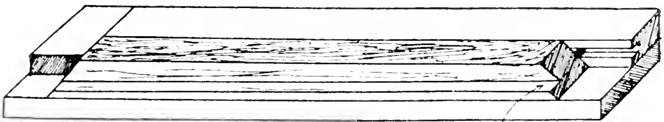
Adjustable guide for planing sides to required width

Fig. 3.



Cross section

Fig. 4.



Support for planing rabbet on lid-pieces

Fig. 5.

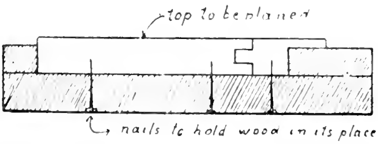
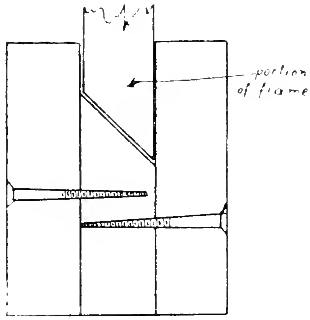


Fig. 6.

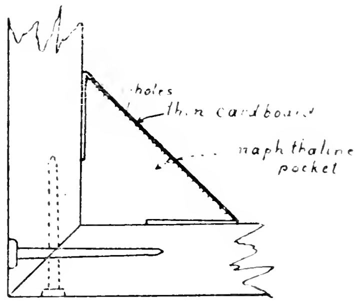
6.) When planed, number the pieces belonging together with the same number, so that they can be re-assembled later. Next the bottoms are cut, and by placing about ten together between clamps they are carefully planed till they have the correct size and shape. One cannot be too careful with this part of the work, as the easy-sliding of the drawers in the cabinets depends on the bottoms to a large extent. The sides can next be glued and nailed together; this, at first, will be found a rather difficult procedure. To avoid spoiling the end resting on the bench when nailing, use a piece of wood as per sketch. (Fig. 7.) First hammer the *cutnails* into the wood till they just come through, then apply the glue and, whilst hot, place the two pieces carefully together pressing firmly with thumb and fingers, and drive the nail further in, and in such a way that the two edges are against each other. (Fig. 8.) Now turn the wood over and drive another cutnail into the other piece at right angles to the first nail. Do the other three corners in the same manner, with the exception that the nails at the front corners are not at right angles, but placed above each other at the side ends. If this nailing and gluing is done correctly, it gives a neat joint. A good carpenter or cabinet-maker may look upon this joint as being amateurish, but there is no other way, I think, that gives such a neat joint in such a short time; and, when well glued, it is much stronger than it has need to be. The four corners occupy me just six minutes! If nailed together properly and if the joint is correctly cut, the frame of the box will be perfectly flat. It is well to test the frame for this before the glue sets, as a tap against one of the corners can remedy any defect; do not think that the bottom is going to pull it right! Next the bottom is glued and nailed on with half-inch "finishing" or "panel" nails. In order to have every angle absolutely as it should be, place the frame on a board, as in sketch (Fig. 9), whilst nailing on the bottom.

When the drawer is ready, the correct lid-pieces are fitted into the grooves and the corners are also glued and nailed. This should be very carefully done, and thin nails must be used, otherwise, as the wood is rather thin here, a weak joint will be formed. When the four corners are all nailed, the lid should be taken off carefully, as otherwise any superfluous glue would fix it on to the drawer. Paint the lid inside with a little white oil-paint in such a way that the rabbet is painted too, this will prevent the putty from coming away from the wood. When dry, place a thin layer of putty on the bottom of the rabbet and gently put the glass on, pressing it well home. The remaining space should be filled in with putty in the same fashion as is done with windows; or, as I did formerly, the glass may be held in its place by a narrow strip of wood screwed on, and planed afterwards. But the first mentioned method is quicker



Block for nailing frame

Fig. 7.



Corner showing method of nailing

Fig. 8.

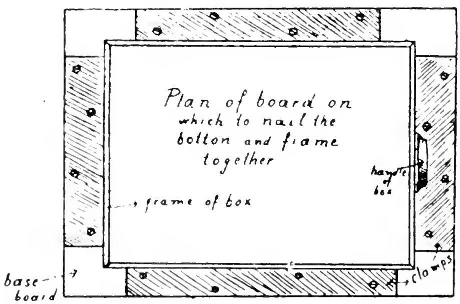


Fig. 9.

and has now stood the test for five years, so I think it will hold out.

I omitted to mention that the little rounded strips of wood (Fig. 1 (*a*)) for the front and the handles, are best glued and nailed on before the glass is fixed. The handles I make of inch-wood, planed first with a slanting edge; then the notch is made at suitable places with chisel and raps, and then they are cut up and finished off.

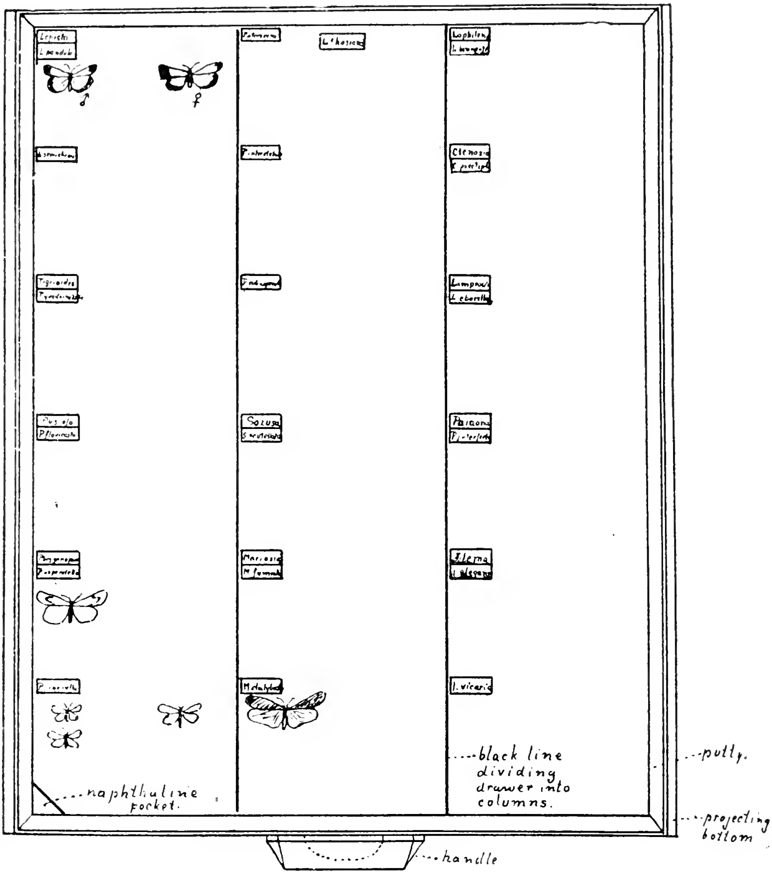
To finish the woodwork I apply a coat of varnish stain to the front only; it is hardly worth while to do the whole box. The bottom of the box should next be lined with a soft material which is glued to the veneer and neatly covered with white paper. A piece of *thin* card-board is glued in one or more corners (Fig. 8); this is afterwards perforated and filled with naphthaline. At the same time the inner sides of the box are covered with white paper. For lining the bottoms, I prefer the ¼-inch linoleum of the finest grain obtainable. It has the advantage over cork of being homogenous and having no holes. Besides, it can usually be obtained locally. German peat is unsuitable as it is liable to corrode the pins and absorbs moisture, which may again be given off to the insects. Pith can never be trusted, as it usually corrodes the pin.

After well filling the naphthaline-pocket, next proceed to divide the drawer into the parallel columns of equal size by means of a drawing-pen and India ink. (Fig. 11.)

The drawers are placed in cabinets in two rows each of 10 or 12 drawers. Two such cabinets may be placed on top of each other, thus forming one piece of furniture, yet being of convenient size and weight to handle when they have to be removed. The drawers slide on metal or wooden ledges in such a way that there is the least possible space between each drawer; this in order to exclude light and dust. For the last purpose some entomologists prefer doors to their cabinets, but for a collection which is consulted frequently I think doors rather troublesome.

Arrangement of Collection.

Before the insects are placed in their permanent places each specimen requires labelling. The rough labels are to be replaced by neatly printed or written labels on which the date and locality is mentioned and any other information such as "bred," "caught at lights," etc. For these particulars symbols or letters are sometimes used, or, better still, a number is given, and this refers to notes made in a special notebook. Some entomologists place numbers only on their specimens Though I did so myself many years ago, I do not think it a good practice. It gives more work in the end, and it often leads to the loss of information, even that of locality and of date; if these are lacking, the specimen is of no great scientific value. The labels should be very small and uniform in size and appearance; mine are 7 by 12 millimetres, and have the collector's name printed on them. A large label is unsightly, it draws attention from the insect, especially when the insect has a wing expansion of 10 mm. or less. Some entomologists use different coloured labels or coloured discs of paper on their specimens to indicate the country or province from which they came. I regard this practice as valueless, the information being placed to better advantage on the label; in point of fact it is a practice that should be avoided Specimens pinned on very short "minutiens" pins should be put on a so-called second mount before they are placed in the drawers. A small piece of pith is cut and fixed to a moderately thick insect pin (Klaeger No. 3) at a height *nearly* that of insects pinned in the ordinary way. The "minutien" pin is fixed into the pith with the head of the moth pointing towards the pin. Some entomologists prefer to have the head of the in sect away from the pin. But as most of these smaller moths have rather long legs, this method of mounting often involves the loss of one or more of the hind legs. these coming in contact with the big pin. Such acci-



Drawer seen from above

Fig. 10.

dents can be avoided by cutting the pith very long, but this looks rather clumsy. The best pith I know is Polyporus pith, sold in strips by Heynes Mathew & Co. and other firms.

If the insects have not been sorted, this should be done after the labelling, especially if it is intended to arrange the collection on a scientific base, which should be the aim of every earnest collector, however small his knowledge of the subject may be.

In most cases, the sorting into the Orders will present very little difficulty, but it is otherwise with the families, genera and species. This requires some knowledge and trained observation. However, I consider it an excellent practice for the beginner to endeavour to place his in-

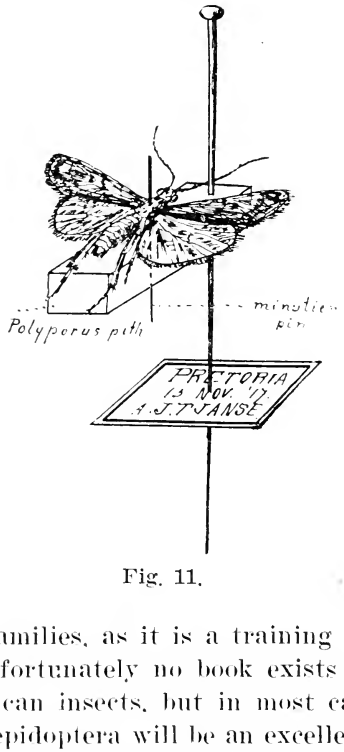


Fig. 11.

sects in their families, as it is a training for more difficult work. Unfortunately no book exists on the classification of African insects, but in most cases any good handbook on Lepidoptera will be an excellent guide, such as Mr. E. Meyrick's "Handbook of British Lepidoptera." If it proves that a sufficient number of readers are interested in the matter, I will at a later date give some articles on the subject in this Journal, and if any difficulties arise with the reader in this and other matters of classification, I am always pleased to assist.

If possible the generic and specific name should be obtained, as this will be a key to any further information recorded bearing on the specimen concerned, and it will enable the amateur to arrange the collection in a scientific order. So as to know how much space should be given to each group and the sequence of the genera, my Checklist of S. African Lepidoptera Heterocera will be found useful.

The name of the family, genus and species is written on special labels about 8 by 26 millimeter and fixed with a very short pin into the drawer. The label with the family name is placed in the centre at the top of the drawer, that with the generic name in the column just above the insect, and that with the specific name either just under the generic label or under the insect. I prefer the first method, as it keeps the two names together, as they should be. The insects are placed in the drawers with the pinning forceps in at least two rows, the left hand row for the males and the right hand row for the females Eight to four species are placed in each column according to the size of the insect and the number of specimens one wishes to collect of each species.

Anything connected with the insect, such as eggs, larvæ, pupæ, etc., might be placed at the bottom of the series of insects, unless one prefers to have special drawers for life histories.

Insect Pests.

If good boxes are well supplied with naphthaline and the before mentioned precautions are taken, the collector need not fear insect pests as much as some lead one to believe. If there are any pests in the boxes, as may be noticed by the presence of brown powder under the specimens, such boxes should be treated at once with carbon bisulphide; and, after seeing the pests killed, extra naphthaline should be placed in the box in order that the fumes may be sufficiently strong to keep living ones out. I doubt whether naphthaline or creosote actually kills pests in an insect drawer as all my experiments in that direction are to the contrary; only carbon bisulphide or cyanide gas kills them. In most cases I think pests are *introduced* when the boxes are reasonably well made; for this reason I advocate the fumigation of specimens before they are incorporated into the collection. The pests that attack the collections, or try to, are usually the larvæ of beetles of the genera *Anthrenus* or *Dermestes,* or mites. The latter are especially troublesome to specimens on the setting-boards, but I find that the sublimating of the setting-board is an excellent precaution against the incursions of these minute nuisances.

Camphor is more expensive than naphthaline, and, although many entomologists still use it, is not as good in my opinion.

Greasy Specimens.

Certain Lepidoptera have a marked tendency to become greasy. This spoils the abdomen and thorax, and often extends over the wings, and so ruins the whole insect. To prevent greasiness, such species as are likely to become so at one time or another, should be treated before setting. The abdomen should be opened on the underside when the specimen is large, or when rather small, broken off and the fat removed mechanically in the one case or by soaking in ether or benzine in the other. This is better than waiting till the harm is done. After the first treatment the abdomen can be filled up with a little cotton wool, care being taken not to remove too many scales and hairs. After the second treatment, it is glued on to the thorax with either shellac dissolved in alcohol or with seccotine. Both these substances can also be used for mending a broken part; but it should be remembered that a repaired specimen is always inferior to one which has its part naturally fixed, however well the mending may have been done. Only specimens which cannot be replaced should be mended. It must not be thought that a repaired or imperfect specimen is of no scientific value. I only wish to emphasise the necessity of handling a perfectly dry specimen with the greatest possible care, and that any repairing, however neatly it may be done, never quite recovers the former value of the specimen.

Mould.

Mould or the growth of fungi on the specimens is another trouble that sometimes utterly ruins them. This may be due to keeping material too long in the relaxing-box or to the insufficient disinfection of the box. It may also result from keeping the collection in too moist a place. This last condition will hardly occur in inland parts of S. Africa; but, near the coast, collectors may have to take special precautions against mould. Cabinets should never be placed against an outside wall and should always stand an inch off any wall, and be raised about three inches from the floor. If the cabinet room is very moist, some dishes of calcium chloride placed about will absorb the moisture to a very large extent. When calcium chloride becomes liquid, it may be heated till all the moisture is driven off, when it is again fit for use. This process can be repeated as often as one likes, and is therefore inexpensive, yet very effective.

Preparing Specimens for Post.

In conclusion, I will give some hints on packing specimens to go forward by post. All dried insects may be sent by sample post, which is inexpensive, and, if the packing is well done, reasonably safe. Heavy packing is out of the question, but mailing boxes should be strong enough to stand any rough treatment they may receive, notwithstanding such written injunctions on the address label as: "With very great care," "Fragile," "Don't throw," etc. In order to pack the largest number of pinned insects into the smallest space, the specimens with large wings can be "shingled"; that is, placed somewhat obliquely so that the wings of one specimen overlap those of any other. I do not advise this method for small specimens, as the risk of breaking off the antennæ, etc., is too great. Large and small insects should never be placed in the same box as if something big comes loose it is almost sure to ruin all the contents. When the bodies of insects are rather big and thick, it is very desirable to place a little ball of wadding underneath the abdomen and put two pins cross-wise over this part, so that, if it comes off, it will not move about and ruin the other specimens. As long as medium sized and small moths are firmly pinned in the cork-lining, there is little risk with proper packing of them coming to harm. Cigar boxes are frequently used for mailing insects because they are so light; but they are hardly strong enough, and the lids are easily pressed in.

The bottom of the mailing box should be lined with cork or cork-linoleum. This should be at least ¼-inch thick, and care should be taken to glue it on securely. The box containing the specimens should be placed inside another box, large enough to allow two inches of space all round to be not too tightly filled with rather fine wood-wool. Unpinned specimens in paper envelopes may be sent in any small, strong box, and will carry safely if they are packed somewhat firmly with a little cotton wool. No outer box is required for this nor for the following mode of packing.

During the last few years most of my correspondents and I myself have used another method of packing unpinned insects. This, on the whole, answers very well, and is certainly less troublesome. A small box, even a matchbox will do, is packed with layers of cotton-wool *which has a thin film* (gum) *on one side.* The cotton-wool is cut to the size of the bottom of the box In packing, a layer of cotton-wool *with the film side downwards* is placed in the box, and a series of moths laid out on this in such a way that they do not touch. A second layer of cotton-wool is laid down and a second series of moths spread over it. This process is repeated until the box is full and the lid can be put on without too much pressure. Before placing the lid, a piece of paper is put on top of the cotton-wool so that the lid will not displace the last layer. The date and locality may be written on this paper. The parcel should be wrapped up well in strong paper, the address and stamps placed on a tag. Naturally the insects must be quite fresh when thus packed, otherwise the legs and antennæ will break from nearly all and ruin them. When in the receipt of such a box of specimens it is a good plan to remove only the lid and place the whole for about 12 hours in the relaxing box, without attempting to see what the contents are. Afterwards the specimens may be removed with little risk. If, however, they are kept under moist conditions for a longer period, the gum dissolves and the insects stick to the wadding. When removed, the specimens should be placed on paper in the relaxing box until they are ready to pin and set.

Obituary.

Robert Andrew Buntine, B.M., M.L.A
(Foundation Member S.A. Biological Society.)

The sinking of the Galway Castle has once again drawn the attention of the members of the South African Biological Society to the horrors and tragedy of war, as amongst the victims of this example of Hun brutality was one of our prominent members, Dr. R. A. Buntine, M.L.A.

Although the deceased gentleman did not take a very active part in the affairs of this society, he took a keen interest in Biology, and shortly before he last left S. Africa, gave a very interesting lecture on this subject to a Maritzburg audience.

Dr. Buntine was born in Australia on November 19th, 1868, and after being educated there, and having taken his medical degree at the Melbourne University, came across to S. Africa. For a short period he held the post of House Surgeon to Grey's Hospital, and then settled down to private practice in Maritzburg, where, owing to his abilities and the affection with which he inspired all his patients, he rapidly attained a very extensive practice, which he carried on until 1915, when he was selected during his absence in England to be the S.A.P. candidate for Maritzburg South. On his return to S. Africa, Dr. Buntine agreed to accept nomination for election, although this naturally entailed a very great pecuniary sacrifice, and at the following general election came out at the head of the poll with a huge majority. From this time onwards he devoted himself to politics and, although not a frequent speaker in the House, was always listened to with respect and attention, as when he did take part in any debate his speeches showed that he had a big grasp of the subject under discussion.

Previously to taking up politics, Dr. Buntine had given up much valuable time to the welfare of the community. He was for many years a member of the old volunteer medical service of Natal, and served through part of the

ROBERT ANDREW BUNTINE.

Boer war, being amongst those besieged in Ladysmith In the Zulu rebellion, he was the P.M.O. of the forces in the field.

Dr. Buntine married, in 1898, Miss M. Pinson, the daughter of the late Mr. Henry Pinson, one of Natal's old settlers. Mrs. Buntine died in January, 1903, shortly after the birth of her younger daughter. The loss of his wife, to whom he was devotedly attached, was a blow from which he never entirely recovered.

In 1912 he sent his two daughters to England to complete their education, and naturally when the war broke out felt a good deal of anxiety as to their general welfare, and consequently paid a flying visit to them in 1915, and again in 1917, intending on this latter occasion to bring them out with him, but as events tragically turned out, most unfortunately did not do so. He then went home in May of last year, and, after doing war work as a member of a Board of Examiners, got a passage for himself and the two girls in October, 1918, when they left England in the ill-fated Galway Castle. When the vessel was torpedoed, his two daughters were put into one of the boats, but Dr. Buntine, with the truly noble spirit which he carried through all his life, remained behind, and left room in the boat for the women and wounded soldiers. Unfortunately the boat in which his daughters were placed was swamped almost directly it was lowered and when the doctor saw this, he immediately jumped overboard to their rescue. The three of them clung to some floating wreckage for some hours, and after being 4½ hours in the water, Noelle, the younger daughter was rescued, but Dr. Buntine and the elder daughter, Jessie, had succumbed to the cold and been drowned before help arrived.

It is no exaggeration to say that Dr. Buntine's death was felt as an acute personal loss by hundreds of people in Maritzburg, who looked on and up to him, not only as a trusted medical adviser, but as a true and staunch friend. It is a thousand pities that such a good life should have been wantonly destroyed in such a barbarous manner.

G. E. O. T.

Obituary.

C. McG. Johnston.

Amongst the ill-fated passengers of the torpedoed steamer "Hirano Maru" was Mr. C. McG. Johnston, at one time one of the Vice-Presidents of the S.A. Ornithologists' Union, and the Secretary of the Central (O.F.S.) Agricultural Society, the O.F.S. Agricultural Association, and the Friesland Cattle Breeders' Association. Prior to accepting these appointments, he was for some years in the Agricultural Department, and was indefatigible in his share in the war waged upon the locusts. He was an enthusiastic protectionist, and it is largely due to his efforts that Korhaan, Plovers and Lapwings were included in the list of protected birds in the O.F.S. Of a cheery, hard-working disposition, his presence will be much missed by those of us who had the privilege of knowing him. An Irishman by birth, Mr. Johnston came to South Africa during the Boer War, and soon set himself to learn the other official language of his adopted country. When he could be released from his various duties out here, he went to England at his own expense, and placed himself at the disposal of the War Office, by which body he was placed under Lord Rhondda in the Food Protection Scheme, and where he did excellent work. When the food crisis was over, Mr. Johnston was released, and returning to his adopted country, perished at the hands of the enemy. Our heartfelt sympathy goes out to his wife and family.

A. K. H.

C. McG. JOHNSTON.

General Notes.

A New Addition to the Transvaal Mammalian Fauna.

In April of this year Miss Olive Stevens, of Stonehenge Estate, Louis Trichardt, Zoutpansberg, sent us an example of the Giant Rat (*Cricetomys gambianus*, Waterh.). This huge rat measures over a foot in length, with the tail another 15 inches or so. It is a tropical African species, ranging from the West Coast (Gambia to Angola) and across to Inhambane on the East. The late H. F. Francis collected a pair at Inhambane, which are in the South African Museum, and it is interesting to know that this animal is also an inhabitant of the Northern Transvaal. I have little doubt that, according to the modern craze for hairsplitting, it will turn out to be a new sub-species, in which case I would like it named after its discoverer. When it dies I will have its skin compared with others in London. Not the least interesting thing about the creature is the fact that on arrival it had dozens of a large parasitic insect running about amongst the fur of the body. These belong to *Hemimerus hanseni*.

A. K. Haagner.

Zool Gardens,
Pretoria, 1.12.18.

Colour Variation in Flowers.

That colour in flowers may vary according to soil or other conditions is well known both to botanists and to horticulturists. Perhaps the best known example of this is *Hydrangea hortensis*, the colour of which varies from blue to pink in many different shades. It is stated that the blue colour may be retained or secured by supplying iron or alum. In nature a similar state of things occasionally prevails, and in this connection an article by

Miss M. H. Mason, published in the Journal of the Royal Horticultural Society, Vol. XXXIX, Part I, may be referred to. Miss Mason there alludes to the variation in colour of *Babiana, Felicia, Haemanthus* and others. As regards *Agapanthus*, she says, "Our blue *Agapanthus* is an instance of varying shade but not of colour. Near Umtata it grows on the precipices above the river an enormous size and the same blue as we see here. This is the usual colour. But at Kokstad I have found it rather smaller in size, and of all shades, from the very darkest blue to the palest grey, though not white."

In all instances there appears to be a gradation in shading, so that a final change to some other colour is not quite unexpected.

The white form of *Agapanthus umbellatus* is generally regarded as being distinct from the blue form, but I think the following history of a plant will show that they are identical and that the colour changes from blue to white and *vice versa* without intermediate shades:—

In 1910 a neighbour of mine gave me a root of the blue *Agapanthus*, taken from a plant growing on his stoep, and which I had frequently admired on account of its fine colour. This root was planted by me in a tin in soil well enriched. The second year from planting the plant bore flowers the same colour as the parent. After this, in the third year, I split up the plant, and planted roots in the garden, retaining, however, a piece which was planted in a fresh tin in similar soil. All these plants bloomed in due course, bearing blue flowers.

In 1915 the plant in the tin, to my surprise, out of five umbels, bore one the flowers of which were pure white, the others being of the original blue colour. This I regarded as a "sport."

In 1916 the same plant, which had been left undisturbed, bore 4 umbels, 2 blue and 2 white.

In 1917 the plant bore 3 umbels, all white.

Up to this time the tin had been standing on bricks, and the roots were therefore confined to the tin. Shortly after the blossoming in 1917, the tin, being just about perished, was placed on the ground, and the roots immediately commenced to enter the soil, and soon had taken fast hold. This soil is the ordinary red soil of Bezuidenhout Valley, and is quite unenriched.

In 1918, 2 umbels were thrown up, and both of these bore the same blue coloured flowers of the original plant.

To theorise is pleasant, though notoriously unprofitable, but I think it may be fairly inferred that the blue colour of the flower is caused by some constituent of the soil. That in 1915 and 1916 the supply of this constituent was becoming exhausted in the tin, and in 1917 was so small that it failed to have any effect, and that in 1918 the roots obtained all that they required and the original colour became restored.

One would have expected from experience with other plants, especially bearing in mind Miss Mason's quoted remark, that the change would have been gradual, and it is not easy to account for the blue and white umbels being so decidedly "self" coloured.

Finally, in support of the statement that the blue and white forms are identical, I may mention the experience of one of the best known Johannesburg amateur gardeners, whose garden is situate on the Northern slope of the hills overlooking the Zoo and plantation, and whose soil differs considerably from mine.

He informed me that he could not keep a blue *Agapanthus* in his garden, as they all changed to white after being planted out.

C. N. KNOX DAVIES.

Johannesburg.

ENTOMOLOGICAL.

MR CLAUDE FULLER, in his First Report as Entomologist to the Natal Government of that day, 1899-1900, under the heading "Insect Friends," page 43, mentions that it had come under his observation that the lady-bird, *Stictoleis instabiles*, Muls., a var. of *S. 22-maculata*, Fabr., feeds upon the larvæ of *Galerucella triloba*, Fabr., an insect that frequents and often completely defoliates the tree *Celtis Kraussiana*, Bunt. There is yet another enemy of the *Galerucella* in the person of a Pentatomide Bug (sub-family Asopinæ), *Macrohaphis* sp.? The larvæ of this bug are beautifully coloured metallic blue with orange red markings. On January 10th, 1919, and subsequent days I found the larvæ of this bug in numbers on young plants of *Celtis Kraussiana* at Winkle Spruit on our South Coast. With hardly an exception every bug larva was busily engaged in absorbing the juices from the body of a *Galerucella* larva. I was also interested in finding one mature bug employed on the same useful task. I have taken also this species of bug on Kaffir-Boom (*Erythrina caffra*, Thb.), where it probably carries out the same useful role of thinning down the numerous *Galerucid, Halticid* and *Hispid* beetles which feed upon the foliage of this tree. The Kaffir-boom is often as completely defoliated as *Celtis Kraussiana*, but the chief culprit in this case is the common yellow and black caterpillar of the Saturnid moth, *Urota sinope*, Westr.

In "Insecta Transvaalensia", page 209, under the description of *Oxyrachis tarandus*, Fabr. (Membracidae) Mr. Distant gives a long quotation from a letter from Mr. Bell Marley of his observations on the development of this Homopteron, in which especial reference is made to the habits of certain small red ants in tending the immature Membracids from which they appeared to obtain a liquid or secretion that was pleasing to them. In fact, that the behaviour of the ants towards the Membracids appears to be analogous with that towards the Aphids. I have two recent observations that bear out this point of view. At the Umgeni Mouth on 16th June, 1918, I came across a considerable number of the young, of what appears to be some small species of the family *Fulgoridae* (sub-family *Cixiinae?* Unfortunately, there were no imagines present to refer to for identification. These insects, some rather large species of ants of the genus *Cremastogaster* were assiduously herding as if directing their movements, sometimes stroking them with their antennae, or even seizing them gently by a leg. The insects were in considerable numbers on the young growing shoots of a bush shrub of which, however, I do not know the name. My second and more valuable observation (as I am able to identify the insect affected), was at Winkle Spruit on the 27th of December 1918 and subsequent occasions.

On the upper stems and shoots of a large leaved bush plant great numbers of *Pedalion delalandei,* Fairm. (Membracidæ), both young and mature, were feeding on the sap of the plant. These were attended by swarms of a small red ant (*Cremastogaster* sp.) and their behaviour was precisely of the same nature as that observed by Mr. Bell Marley in reference to *Oxyrachis tarandus,* Fabr. I noticed, however, that the mature insects kept apart and were not seemingly molested. The young insects of this species bear upon the prothorax a somewhat loosely fitting raised shield, culminating in a sharp pointed spine, projecting forwards. There is no posterior projection to the process as in the adults. The mature insect is figured and described in Distant's "Insecta Transvaalensia," page 212.

It appears likely from the above and other records that there may be a considerable number of Homoptera utilized by the ants as milch cows, as well as the Aphides

C. N. Barker.

Durban, Natal.

Ornithological.

For the past fortnight I have been enjoying myself amongst the birds at Walfish Bay, which is a perfect Paradise for a lover of sea and shore birds. Flamingoes of both species are here in thousands, and all sorts of sandpipers, gulls, terns, etc. I hope to write a full account of the birds I have met with here later on, but in the meantime I should like to place on record one or two of the more notable species I have collected.

1. *Tringa subarquata.*—Curlew Sandpiper. I shot a specimen of this Sandpiper a few days ago. It is a common species in many parts of Europe.

2. *Limosa sp.?*—Godwit. A few days ago I shot a specimen of a Godwit—which I believe to be the Bar-tailed Godwit, but have no description here to verify it from. I have seen two or three others. This is the second record of this species from S. Africa: one specimen each of the Bar-tailed and Black-tailed Godwit having been collected by Mr. Millar at Durban.

3. On the 18th of the present month I shot a specimen of what I take to be the Common Tern. *Sterna fluviatilis* bearing on one of its legs an aluminium ring on which is engraved the following: „Kielmond Rossia. 592". It would be interesting to know the history of this bird.

4. *Aegialitis venusta.*—Fisher's Sandplover. This little Sand-plover, which is usually considered rare is exceedingly common here, and I have secured five at one shot. This may, however, be *rufocinctus* of Reichenow, but I do not know how this differs from *venustus.*

C. G. Finch-Davies, Lt.,
1st S.A.M.R.

Walvis Bay,
S.W. Africa.
20/10/18.

Game Reserves Commission: Report.

(Transvaal Provincial Administration.)

The Report of the Commission on the Game Reserves of the Transvaal is exhaustive and full of information. It contains three maps. The Shingwidzi Reserve is stated to comprise 1,593,890 morgen and the Sabi Reserve, 1,210,000 morgen. It is noted with pleasure that the Commission does not suggest the reduction of the areas; on the contrary it is recommended that they should remain the same until the demand for white settlement becomes much greater. A larger staff of Rangers is recommended, and a suggestion is thrown out that better facilities should be offered the public, more especially scientists, to visit these game sanctuaries where most of our beautiful antelopes can be seen under natural conditions. This and the final recommendation of the Commission, that the Reserves should be ultimately and definitely created into a National Park for all time is heartily endorsed.

A. K. H.

ENQUIRIES.

(1) Professor Z. P. Metcalf of the North Carolina State College of Agriculture and Engineering writes:—

I write to inquire whether it would be possible to secure either by purchase or exchange species of Homoptera belonging to the following families: Cicadidae, Membracidae, Fulgoridae, Jassidae and Cercopidae, either through your Institution or some one in your vicinity.

Mr. Levi W. Mengel, Director of the Reading Public Museum and Art Gallery, Reading, Pa., U.S.A., writes as follows:—

I am interested in the diurnal lepidoptera of the world, and I am writing to you as an entomologist asking you if you can put me in communication with any person or persons from whom I could purchase perfect specimens, from your locality, in papers. They do not need to be named, just so that the exact locality is indicated and the specimens perfect.

We have access to the best libraries in America and our own collection here contains about 35,000 specimens, but we are desirous of obtaining many more of the common material, which we use in the Museum's work.

Notices and Reviews.

Proceedings Zoological Society.

Part I. (March 17). Parts III. and IV. (Feb. 1918). Note.—Part II. missing—will be reviewed later). The following are the papers and more noteworthy exhibitions:

Mammals: R. I. Pocock: Exhibition of lantern slides showing the Beavers work in the London Zoological Gardens, p. 100.

R. I. Pocock: Exhibition of head of castrated Bushbuck, and antlers of the Pere David's Deer, p. 337.

Prof E. Wood Jones: Exhibition of skull of lioness showing effect of captivity, p. 333.

Prof E. Wood Jones: The structure of the orbito-temporal region of the skull of a lemur, p. 323.

Prof. J. P. Hill: Lantern exhibition of new born marsupials, p. 337.

Sergius Alpheraky: Deformity of *os penis* in a Seal, p. 251.

A de Carle Sowerby: On Heude's collection of Chinese mammals, p. 7.

Birds: Dr. Branislav Petronievics and Dr. A. Smith Woodward. On the pectoral and pelvic Arches of the British Museum specimen of *Archaeopteryx*, p.l.

Fish: Ruth C. Bomber: Note on a Hermaphrodite Dog-fish (plates I. and II., p. 217).

Invertebrata: L. A. Borradaile: On the structure and function of the mouth parts of the Palaemonid Prawns Text figures 1 to 51, p. 37.

Frank E. Beddard: On the scolex in the Cestode Genus Duthiersia and on the species of that genus. Text figures 1 to 5, p. 73.

C. J. C. Pool: (1) Coleoptera of the family Cissidae found in Great Britain, with descriptions of 2 new species. (2) A new species of the Coleoptera genus Cryptorrhynchus, Illiger, p. 83.

F. F. Laidlaw: Additions to Dragonfly fauna of Borneo

Lt. Col. J. M. Fawcett: On Mr. Feather's collection of Heterocera from British East Africa.

J. J. Joicey: Five papers on Lepidoptera.

H. D. Babcock: Antlike spiders from Malaya.

Avicultural Magazines 1918.

The following are papers of general and South African interest. March, 1918. A short paper on the Jackass Penguin (*Spheniscus demersus*) with photographic plate and an editorial note.

"Birds of Gambia," by Dr. E. Hopkinson, D.S.O. A short account of the birds of this West African Colony, including a number of species found in South Africa.

"Sunbirds in captivity," a short review by Dr. Hopkinson of the history of keeping sunbirds in cages, from the earliest failures, to the successful methods of to-day.

"Development of Pattern in Birds," by Dr. A. G. Butler. An interesting paper illustrated by a photograph of our Crowned Hawk Eagle (*Spizaetus coronatus*) and continued in the April number.

"Ostriches," by Dr. J. K. Butler. (April and May).

"The Principal Zoological Gardens of the World." In this list it is noticed that the Director of the Pretoria Zoo is given as Dr. J. W. B. Gunning, who died in 1912, and was succeeded by the Supt. Mr. A. K. Haagner, in 1913—5 years ago.

"Ancestral characters in nestlings." by Dr. A. G. Butler (May and June).

"Owls nests and their contents," by E. J. H. Gurney (June).

"Colour change without a moult," by Dr. A. G. Butler (September). This is the first instalment on an interesting subject, upon which Zoologists still disagree.

The Emu: Organ of the Australasian O.U.

The number for October, 1917 contains two articles of some interest to S.A. Ornithologists: "Australian Ibises" by W. H. D. le Souef, amongst which are included the Glossy Ibis (*Plegadis falcinellus*) which the author says is a rare bird in Australia.

"White-winged Black Terns in Australia," by W. B. Alexander. The author describes what he calls a "remarkable visitation" of this species (*Hydrochelidon leucoptera*).

The number for April, 1918, contains a paper on "Bird Protection in Queensland," by D. H Chisholm, which might well be read by our members. Both this and the former number are profusely illustrated by beautiful photographs and a coloured plate.

British Birds.—January-April, 1918. "Notes on the Moorhen," by Miss Francis Pitt. "Moults and sequence of plumages of British Waders," by Annie C. Jackson. There are a number of short notes of general interest.

El Hornero: Ornithological Society of La Piata (Buenos Aires) May, 1918, contains an interesting article on the *lariformes* of the Argentine Republic by Robert Dableuc. This includes a migrant to South African *Larus cirrhocephalus*, with a drawing of the wing patterns.

The Ibis: A quarterly journal of ornithology.

In the number for January, 1917, Mr. F. E. Blaauw gives an account of the breeding of the S.A. Blackduck (*Anas sparsa*) in captivity. The paper is accompanied by a plate of six goslings in the downy stage. Mr. W. R. Ogilvie Grant writes on some recent collections of birds, made by Mr. G. W. Bates in the Cameroons. This is illustrated by a coloured plate of the head of three species of *Heterhyphantes*. A few species to be found in South Africa are discussed.

The number for April, 1917, contains an obituary notice, with photograph, of the famous big game hunter and naturalist of South Africa, the late Capt. F. C. Selous, D.S.O., who was killed in action in East Africa, 4th January, 1917, at the age of sixty-seven.

The number for July, 1917, contains a paper on a collection of birds from two districts of B.E.A. by Lieut. C. W. Mackworth-Praed, M.B.O.U., Scots Guards.

In the number for January, 1918, is an interesting article by E. C. Stuart-Baker on "Erythrism in Birds Eggs." The author divides this property into 2 classes, normal and abnormal, and considers the orders, families, genera, species and sub-species in sequence as written. Our Vice-President for Rhodesia, contributes a paper on "Rejections by Birds of Eggs unlike their own, with Remarks on some of the Cuckoo problems." Mr. Swynnerton details a host of interesting experiments carried out by him, and discusses the subject generally.

In the number for April, 1918, Mr. Hugh Gladstone gives a "Note on the structure of the Feather" (Plates V.-VII.), and there appears also an account of the annual general meeting of the B.O.U., from which we notice that Dr. W Engle Clarke, L.L.D., F.L.S., F.R.S.E., was elected President.

The number for July contains a long paper on the Birds of Anglo-Egyptian Soudan, Part I. *Corvidae Fringillidae* by W. L. Sclater, M.A., etc. This refers to the *Passeres* only and we see that two new forms (geographical races or sub-species) from South Africa have been described, *Sylvietta rufescens transvaalensis* from Rustenburg, Transvaal, and *Hirundo puella unitates* from Pinetown, Natal.

In the number for October, 1918, Mr. G. L. Bates gives an instructive paper on the "Reversed under Wing—coverts of Birds and their modifications, as exemplified in the Birds of West Africa." Mr. B. B. Riviere writes on "European Birds met during a Short Visit to South Africa." Mr. Riviere gives October 5th (Cape Town), and 17th October (Lake Chrissie) as the earliest dates on which he saw the European Swallow. This seems to the reviewer an extraordinarily early date. Might not the author have confused the African White-throated Swallow with the European species (which it closely resembles), more especially as he remarks " these birds struck me as being very pale on the chin and forehead "? It would be interesting to know whether Mr. Riviere handled any specimens.

" *The Principal Species of Birds protected by Law in Egypt.*" By Capt. S. S. Flower, F.L.S., F.Z.S., M.B.O.U., Director Zoological Service, Egyptian Government, and Mr. J. Nicoll, F.Z.S., M.B.O.U., Asst. Director Zoological Service, Egyptian Government. (Cairo Government Press, 1918.).

This admirably got up little brochure is published by the Ministry of Agriculture and only shows one side of Capt. Flower's many activities. Law No. 9 of 1917 was promulgated prohibiting the destruction of certain insectivorous birds, which are useful to agriculture, and to aid the layman, agriculturist, sportsman and others this booklet was published. The scientific, English, French and Egyptian names are given, with short descriptions, measurements and coloured plates of the species. A similar pamphlet issued by our own Agricultural Department would fill a much-felt want

Oort E. D. Van. Ornithologia Neerlandica. De Vogels van Nederland. The Hague, 1918, Parts 1 and 2 with excellent lithographs in colours. *folio. Gld.* 25.

This work is written by the well-known Director of the State Museum of Natural History at Leyden, and will be issued in 40 parts containing 400 coloured plates. The price of each part is for subscribers, Gld. 12.50. Each year 4 or 5 parts will be issued. The work will be divided into 5 volumes; the text is in the Dutch language. It will be the standard work on *Dutch Birds* and will replace the old works of Sepp and Schlegel, now out of date

Pelt Lechner, A. A. van. Oologia Neerlandica. Eggs of birds breeding in the Netherlands, 1910-1913, 2 vols. English text. With coloured plates (191): illustrating some hundreds of eggs, drawn from specimens in the author's collection, 4to. half morocc. Gld. 112.50 plus 5% temporary extra charge. *Publishers*: N. V. Martinus Nijhoff's Boekhanden en Uitgevers-Mij. 'S'Gravenhage.

A. K. H.

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