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BRANCH FACTORY:
THEATRE STREET.

W.A. Nicholson Esq.,
51, Surrey Street,
NORWICH.

Dear Sirs,

With further reference to your letter of the 21st inst. we have now had our books searched, and beg to hand you a list herewith of the dates on which the Transactions were invoiced to the Society in each of the years from 1870 until now.

As we have mentioned previously, we cannot guarantee that these dates represent the dates of actual delivery, in fact comparing the last three dates with the actual dates of delivery, shown by our outwards delivery books, we find the following comparison

<u>Dates of Books being sent home</u>	<u>Charged</u>
July 6th, 7th, 1906	July 7th, 1906
Aug. 16th, 17th, 1907	Sept. 1st, 1907
July 27th, 1908	Aug. 1st, 1908

Prior to 1906 we worked our delivery books on a different principle, and only used them where more than one separate consignment was made. Although we have searched back as far as 1882 we are unable to find any entries of the Transactions in the earlier delivery books, and are afraid therefore that the list given herewith is all the information we can give you. As it is what Mr. Sherborn requests, we trust that it

We are,

Yours faithfully,

H. R. Fletcher

Date of Invoice

1870.	March 28th.
1871	May 30th.
1872	May 20th.
1873	May 16th.
1874	June 6th.
1875	May 25th.
1876	June 17th.
1877	June 1st.
1878	August 19th.
1879	August 6th.
1880	July 22nd.
1881	August 4th.
1882	September 9th.
1883	July 18th.
1884	September 15th.
1885	September 26th.
1886	June 20th.
1887	July 18th.
1888	August 9th.
1889	August 15th.
1890	June 30th.
1891	July 9th.
1892	August 15th.
1893	September 29th.
1894	July 13th.
1895	August 26th.
1896	September 1st.
1897	July 8th.
1898	July 12th.
1899	September 5th.
1900	September 7th.
1901	July 29th.
1902	July 28th.
1903	August 19th.
1904	September 30th.
1905	September 2nd.
1906	July 7th.
1907	September 1st.
1908	August 1st.



TRANSACTIONS
OF THE
NORFOLK & NORWICH
NATURALISTS' SOCIETY.

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*The Norfolk and Norwich Naturalists' Society has for
its objects:—*

1. The practical study of Natural Science.
2. The protection, by its influence with land-owners and others, of indigenous species requiring protection, and the circulation of information which may dispel prejudices leading to their destruction.
3. The discouragement of the practice of destroying the rarer species of birds that occasionally visit the County, and of exterminating rare plants in their native localities.
4. The record of facts and traditions connected with the habits, distribution, and former abundance or otherwise of animals and plants which have become extinct in the County; and the use of all legitimate means to prevent the extermination of existing species, more especially those known to be diminishing in numbers.
5. The publication of Papers on Natural History, contributed to the Society, especially such as relate to the County of Norfolk.
6. The facilitating a friendly intercourse between local Naturalists, by means of Meetings for the reading and discussion of papers and for the exhibition of specimens, supplemented by Field-meetings and Excursions, with a view to extend the study of Natural Science on a sound and systematic basis.

Acad., etc. - Norwich

TRANSACTIONS

OF THE

NORFOLK AND NORWICH

NATURALISTS' SOCIETY.

VOL. I.

1869—70 to 1873—74.

Norwich:

PRINTED BY FLETCHER AND SON.

1874.

BRITISH MUSEUM
NATURAL HISTORY
LONDON



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1869-70.

Norwich:

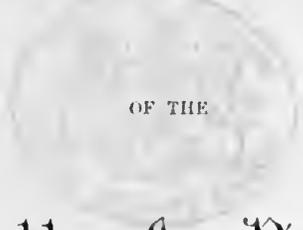
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Norwich:

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1870.



A D D R E S S

Read by the President, the REV. JOSEPH CROMPTON, to the Members of the Norfolk and Norwich Naturalists' Society at their first Annual Meeting, held at the Norfolk and Norwich Museum, March 29th, 1870.

WHEN I had the very pleasant honour of opening the proceedings of this Society I said I would accept the position of your President, then, rather than later, because I might be fit to rock the cradle though I certainly could not venture to be the guide of the Society when of full age. That first year's duty closes to day, and I think we may congratulate ourselves that it has been fairly successful in itself, and promises well for the future. Our meetings have been well attended, our papers good in point of number and variety, while, as to interest, our first "transactions" speak for themselves. Our excursions have been pleasant and profitable, and while we have to acknowledge the hospitality we have received from the various gentlemen and clergy who have helped to make our trips useful and agreeable, we have reason to believe that our visits have left impressions behind, not only as of a passing pleasant acquaintance, but of a more lasting kind. We have not only met with valuable specimens of natural history, but have discovered or made new friends, because we have stirred up a common interest in the beautiful works which are our study.

We are working now with two companion Societies, the Geological and the Meteorological. The former has its own times and work, but has joined us in some excursions, and I trust will often do so in future: the latter is as yet very quiet but very busy. It has made no public sign save the anemometer over our heads, but it is doing its appointed work of gathering and registering facts

patiently and continually, and I would venture to suggest that its members might from time to time present to us some of the more important and interesting results as they are gathered from their valuable set of instruments.

In reviewing the papers which have been read to us during the past year, I have at the outset to express my regret that the funds at our disposal compel us, very reluctantly, to omit from the transactions several papers of more than ordinary interest, but whilst expressing our regret to those whose contributions we have been compelled to exclude, it must be considered a matter for congratulation that the material exceeds our means, rather than it should fall short of it; we hope another year to present our Members with a fuller set of transactions, doing more justice to those who are good enough to favour us with papers.

Commencing with Zoology, we have to thank Mr. John Henry Gurney for his valuable contribution in the form of "Notes on the Norfolk and Suffolk Mammalia." Mr. T. E. Gunn also read a paper on the same subject, which will be found printed in the "Zoologist."—S.S. pp. 1925—7.

On Ornithology we have had two papers from Mr. Southwell, one on the "Flight of Birds," which I think we may point to with becoming pride, I venture to say it would do credit to far older and better known Societies than our own; the other on the "Ornithological Archæology of Norfolk," which I am sorry we are unable to print, as it contains information derived from many sources, (some of which are difficult of access,) as to the state of the country in former times, and the birds which are recorded as inhabiting it. Commencing with a description of the physical features of the county, as described by Fuller, Camden, &c., with the birds found in their days, it glances at the state of the Ornithological population at three different periods; first about the year 1519, from records in the "L'Estrange Household Book," then 150 years later in Sir Thomas Browne's time, and finally 150 years later still, at the time the Rev. Richard Lubbock wrote his observations on the "Fauna of Norfolk." Referring to the disappearance of birds, once common in this county during the breeding season, Mr. Southwell states that, during the 150 years preceding the commencement of the present century, only two species had ceased to breed here, whilst in the next 50 years no less than six species

entirely deserted us, five others virtually ceased to breed here, and several others are rapidly disappearing. Mr. Stevenson also, giving us from time to time the overflowings of that book, which is his only excuse for not having been your president for the past, or allowing himself to be nominated for the coming year, has brought before us facts of our local Ornithology touching "Migration of Birds," "Occurrence of Rare Visitors"—Richards Pipits, Shore Larks, Little Gulls, &c.—The "Mortality last spring amongst the Swallow Tribe," and other topics for which I must refer you to our Transactions; also an interesting paper on the "Black Headed Gull," read at the Scoulton excursion, which we are unfortunately unable to print; while his paper on the "Meres on Wretham Heath" will be acknowledged to be one of the strong points of our first Transactions;—the whole of his contributions, I hesitate not to say, forming an addition to the records of English Natural History from our Society, which will be as welcome to naturalists far away from our corner of the land, as it is sound in character; and we hope they will be continued for many years to come. Mr. T. E. Gunn has also kindly added to the interest of many of our meetings by exhibiting rare birds which have come into his hands. To Mr. Crowfoot, of Beccles, we are indebted for some interesting notes on certain rare European birds and their eggs.

On Entomology we began almost with Mr. Crowfoot's paper on the study of that science. Our country friends and Members are most valuable to us; none more so than Mr. Crowfoot. We enjoy their company when they visit us or we visit them, but in his case we must regret that the Great Eastern Railway makes the 16 miles distance between Beccles and Norwich into at least sixty, besides the constant danger, even to hardy out-door naturalists as ourselves, of catching rheumatism and catarrh, and losing our temper by the weary delays at Haddiscoe and St. Olaves. If this obstacle could but be removed we should welcome Mr. Crowfoot oftener, and perhaps might gain from him, for ourselves and our city, far fuller scientific information than our papers can contain!

Mr. Barrett with his observations on a new farmer's pest in barley, has borne out the hopes expressed, in my opening address, of the practical value of which our Society may be; by his re-discovery of *Hydrilla palustris*, he has restored this species to the British list, and his captures of *Nothris verbascella* will show our

Society is doing its work, both by verifying former observers and in preserving our knowledge of objects specially interesting from their extremely local habitat. We shall not soon forget Mr. Barrett's exhibition of *Crambus Pedriolellus* and explanation of its delicate silken cocoon, (his note on which we are compelled to omit) to me at least it will add a new and unexpected pleasure to a visit to the dunes of Yarmouth, where alone in this country, this extremely local species is found, and which locality otherwise, even the genius of Dickens could only compare to pieces of "toast in water."

Passing to Botany, I beg to call attention to Mr. Geldart's paper, as one calculated to be of permanent value to Norfolk botanists in all time to come, as by defining the botanical districts of the county he has enabled practical students of the science so to register their separate facts as to render them truly effective contributions to our knowledge. Every suggestion by which an observation can be made accurate in date and place, and with relation to other facts, is in reality to give that observation a true scientific value, without which it is only a curiosity to be forgotten or to become lumber.

A paper by Mr. Corder on the Genus *Lastrea*, in which he records his reasons for maintaining *Lastrea cristata*, *L. uliginosa*, and *L. spinulosa*, to be true species, shows his minuteness of observation, and gives some of us, who are not minute botanists, an insight into the difficulties on the subject of species and varieties upon which deep scientific questions now turn, and which present themselves more and more as each department of natural science is investigated.

Dr. Beverley's paper, read to the Members at Brook, illustrating the botany and other natural features of that charming district, and forming so appropriate an address at the close of a delightful day, calls forth, once more, our regrets that the smallness of the sum at our disposal renders it necessary to omit a paper which would, we feel assured, have afforded those who were not present on that occasion much pleasure in perusing.

In drawing this rapid summary of our proceedings towards a conclusion, let me hope that our heading of "Miscellaneous Notices and Observations" will in future years receive large additions, and be carefully watched by the Members of the Society. It will be, I expect, a sort of naturalist's carpet bag, never full, but always able to hold one last thing more. Out of such miscellaneous but accurate jottings and notes, other and distant naturalists will gather

information of value for comparison with their own observations, or for exchange of intercourse with us, while by their careful accumulation and registry future naturalists will draw their facts for wider generalization, or mark the gradual changes of flora and fauna of our country. Our bag for this year contains some notable contributions, beyond those I have mentioned, by Mr. Bayfield with his "Mole Cricket, in September," Mr. Field with the "Devon Pine Fruiting this last year," besides Mr. Crowfoot's "Nests and Eggs," and our usual monthly contributions at the meetings of the Society.

I venture to press on our country Members the interest they have in their power to add to our Society, by making, preserving, and communicating observations on points of natural history in their localities. Mr. Crowfoot and Mr. Lawrence have shown, in different ways, what can be done; and the ever memorable White's History of Selborne reveals the easy and attractive method of doing real service to science without the pretension or the anxiety of making elaborate contributions.

Our excursions to Horstead, Scoulton, Brooke, and Stoke Holy Cross were decided successes, while, if we were a little late for Ranworth, the day was a very pleasant one for all of us who were there, and let me add that even archæology in Mr. Bayfield's, Mr. Bayley's, and Mr. Lawrence's hands, though out of our direct line and scope, has given a not unwelcome zest to our trips, if only in reminding the student of bird, beast, insect, and creeping thing, that the highest study for man is man, whether in his physical or mental history.

Lord Kimberley, on becoming a Member of our Society, expressed a hope that we might be of practical use in protecting and preserving from destruction the various interesting objects of our studies, to which end we would remind his Lordship and other proprietors of large estates, that much may be done individually, by peremptory orders to their game-keepers to spare the occasional visitants to their woods and waters. I would especially call their attention to the valuable information as to the food of birds, contained in the report, delivered at Exeter this year, of the committee appointed by the British Association, at their meeting in this city, to consider the practicability of establishing a "close time" for the protection of indigenous animals.

We cannot but rejoice at the passing of the "Sea Birds Preserva-

tion Bill," the good effects of which, we may hope, a few years will show. If its provisions are proved to be imperfect, our Society, with all kindred associations, will be called on to press for their amendment; I only wish its provisions could be extended to small birds during their breeding season. In this point of view I am glad to notice the efforts of the Yare Preservation and Anglers' Society, and though personally I have as little admiration for what are called angling matches, as for battues in game preserves, and beg to deny either the name of true sport, I hope the prophecy of our Anglers' Society, that better drainage and a clean river will ere long bring fish up to Trowse eye and above it, may prove true.

Gentlemen, I have rocked the cradle, I trust you can run alone now, and that the coming year will be richer both in papers and field work than the past one has been. It cannot be much more harmonious or pleasant than the one over which I have had the honour to preside.

Norfolk and Norwich Naturalists' Society.



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C. G. Barrett	J. Reeve
H. D. Geldart	Thos. Southwell

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Farrer J. D., Bracondale
 Ferguson-Davie Rev. C., Yelverton
 Field Edward
 Fitch Robert, F.G.S.
 Fletcher B. E.
 Fox F.
 Francis W. B.

G.

Gambling J., Buxton
 Gedge Dr., Cambridge
 Geldart H. D.
 Gibson C. M.
 Gibson R. Edward
 Gilbert S. R.
 Girling Rev. J. C., Hantbois
 Glasspoole H. G., Ormesby
 Gunn Rev. J., Irstead
 Gunn T. E.
 Gurney John, F.Z.S., Sprowston
 Gurney J. H., Junr.

H.

Hancock Thomas
 Harvard S.
 Howes James
 Hunt J., Junr.
 Hutchison G. S.

K.

Kent A.
 Kett G. S., Brooke
 King J.
 Kitton F.

L.

Lawrence Rev. C., Thurton
 Lawrence Rev. A. J., Berghapton
 Le Pelley Rev. J. L., Thorpe
 Ludlow H. J.

M.

Martineau Miss
 Master A.
 Morgan A. M. F.

N.

Newcome E. C., Feltwell

P.

Paul W. F., Ipswich Road
 Pinder T. R.
 Priestley C., Norfolk and Norwich
 Hospital
 Purdy Robert, Foulsham

R.

Rackham T. J. C.
 Reeve James
 Reeve Mrs.
 Richardson T. W.
 Roberts Captain
 Robinson H. S.

S.

Saunders James
 Sawyer J. R.
 Slack Thomas
 Smyth Rev. J. D. H.
 Southwell Thomas
 Stevenson H., F.L.S.
 Stracey Miss F.
 Sutton Fras.
 Sutton F., Borough Lunatic Asylum

T.

Taylor J. E., Bracondale

U.

Upcher Rev. A., Wreningham
 Upcher A.
 Utting Stephen
 Vincent Rev. W., Postwick

W.

Walker Edward
 White E. W., Norfolk and Norwich
 Hospital
 Williams Charles
 Wilson George
 Wilson Miss

APPROXIMATE STATEMENT.

THE TREASURER IN ACCOUNT WITH THE NORFOLK AND NORWICH
NATURALISTS' SOCIETY.

		Dr.	Cr.		
		£ s. d.	£ s. d.		
1869—70.	112 Subscribers	.. .. 28 0 0		Matchett and Stevenson, Printing, Stationery, &c.	3 4 3
				Fletcher, Printing, &c.	.. .. 3 4 0
				Jarrod, Stationery	.. .. 0 12 6
				Norwich Mercury, Advertisements	.. .. 0 2 6
				Disbursements by the late Secretary	.. .. 3 5 9
				Grant towards alterations in Museum *	.. .. 3 0 0
				Fletcher, Estimate for Printing "Transactions"	.. 12 2 6
				Balance in hands of Treasurer	.. .. 2 8 6
		<hr/> £28 0 0 <hr/>			<hr/> £28 0 0 <hr/>

* Alterations, made conjointly with the Geological Society, for holding Soirées and Lectures in the Museum.

I.

ADDRESS

*Delivered by the President, the REV. JOSEPH CROMPTON, to the
Members of the Norfolk and Norwich Naturalists' Society,
at their First Meeting, on April 27th, 1869.*

THE PRESIDENT said it becomes my duty to open the proceedings of the Society with a few words. In doing so I hope to throw out some thoughts that may indicate what seems to me to be the scope of our Society, and to give some hints also in regard to our actual work and proceedings during this year. I am of course flattered by being appointed your first president, but I feel that if I am ever to be president of such a Society as this, it must be now, for it is easier to rock the cradle than to drill an adult, and I consider myself as rocking the cradle of this Society. There was a time when I thought I did know something about Natural History. In those days when one was a student under Lindley and others, one did think that one was in the way of getting a little knowledge, but like the lady in one of Goethe's works, who knew enough to listen with intelligence when wise men spoke, I can just do that, for all things in science are going on so fast, that a man occupied in other professions and other work requiring time and attention, cannot keep up with it. The worst that can be said of your Society is, that you have a parson at the head of it. A great German writer said that all members of the clerical profession should strive to get some department of God's works outside their regular routine and professional duties, and by studying it, widen their minds and keep their hearts open. That has been my feeling all through life. Although I was led in early life to take an interest in various departments of knowledge, I know that of many of my cloth it may be said that we are "Jacks of all trades,

and masters of none," but still I believe that it is better to have a smattering of a good many things, than total ignorance of all.

During nearly thirty years that I have lived in Norwich, it has been satisfactory to see that there is a decided step being made in the love of all departments of knowledge and science. I can remember when there were one or two little clubs just dying out—little private societies, at which papers were read, and which did a deal of good. I remember myself being a member of such a society. It had three members when I joined it, and we soon finished with being a nice little gossiping club. Mr. Fitch was one of the members, and at his house the last meeting was held. Some of us tried to stir up the Norwich people, and one after another of these societies arose and died away, each rotting and adding something to the soil. It may be the fate of this society to die also, and if so, we shall leave a nice little *debris* for other people's benefit afterwards. Here we are, then, trying to form what seems to be a wider and larger, and, I fancy, more promising society than any that has arisen in Norwich. Let us look at the scope of this society, and what it is to do if it comes to maturity, and does its work in life. You have first to take a wide sweep over all nature's works, except the field of geology. We have a society of geologists, and let us leave them to their special department, only we ought to work in alliance and in union with them, for all parts of knowledge, all parts of nature, are allied to each other. There is no such thing as a scientific man worthy of the name who confines his attention to one subject, however important, without looking at the relation which science shows it has to the things around it. I remember a severe lesson being given to some of the scientific men of the last generation. At the Bristol meeting of the British Association, Mr. Cross, of Taunton, brought forth his extraordinary experiments in electricity, and next day Professor Sedgwick, Buckland, and one or two more were not to be found. Enquiry was made, and it was found they were in bed; they had been so excited the previous day that they could not get up—they were scientifically intoxicated, and had to sleep it off next morning. The chemists came to their rescue, and said they ought to have known better, they ought to have known that certain French chemists had anticipated Mr. Cross in some points; and the consequence was that the geologists had to eat humble pie

next day, and confess their ignorance of chemistry. They had studied their own particular topic, but had not studied its relation to chemistry. I hope we have all got beyond that, and although we do not touch geological points particularly, still geology will be of assistance to us, and we to it. Our variety of pursuits will be our bond of union; we have no narrowness, no separation in this room. Some of us may know a great deal upon one topic, some nothing, and some a little; and we shall want patience and perseverance—patience to learn to understand how our friends' favourite topics bear upon our own special pursuits. As to that particular sin which still exists among scientific men as elsewhere—jealousy between one branch and another, we must consider that banished and never to enter here.

As your president, there is one particular danger that I must warn you against, namely the tendency to indifference. Conchologists may not care to consider other branches, and entomologists or microscopists may not care much for alliance with their neighbours, whose special pursuit is conchology or ornithology. One may be very learned in one branch, and show indifference towards the branches in which his neighbours are interested, but it is our duty to get rid of all that, and to find that our several topics have connection one with the other. I hope to see Mr. Gunn here as head of the Geological Society, and that we shall have assistance from the geologists, for just as physical geography is only a phase of geology presenting the superficial and geological aspect of the earth, so there is no department of science which has not a relation to others as geology has to nearly all. I do not think our botanists will go far without claiming assistance from geologists to explain the existence and decay of plants that flourished in the past. So in regard to the other branches of our society. We shall start from our own district, as the geologists have done, and we shall have to ask, and I hope we shall get, papers and discussions on the botany of our district; and we must make a register of the plants growing in this district, their localities, and their conditions. I cannot conceive how you can have a proper understanding of the flora of this district without knowing something of the soil, and there we shall have to ask for the assistance of the geologists. At our very starting we ought to have it impressed upon all our members that we are not to be destructive in our hunting. We ought

to have an understanding that we are to be scientific, but not destructive. For if the society is to go in a body to hunt for rare plants, existing only in special localities, and each one claim to take a specimen, it will become a pest to all true lovers of science, and a dread to all sensible occupiers of land.

There is another thing strikes me, from the experience I have had of other Societies, namely, that we should assert the rights of the poor, and our own rights therewith, in keeping open footpaths. I have seen a great tendency to make bridle-paths into footpaths, and footpaths into no paths at all.

No one likes to go to battle with the authorities and the powers that be, but a Society can send a lawyer's letter, and I know of a Society which was the means of keeping open many footpaths, and was of great public service in this way. We ought to take care that we do not let public rights be trespassed upon, and our walks shut up from us by the selfishness of the powers that may happen for the time being to be owners of the land.

I remember, in the first volume of John Stuart Mill's book on political economy, that cold, logical book, the necessity of commons and waste places is insisted upon. One would have thought this would have been one of the last things to be found in such a book, but it so happens that John Mill is a botanist, and, therefore, you can comprehend why he wishes to keep the commons and waste places intact. He finds a reason for it in political economy, but I suspect the botany was father to the wish. He loves his political economy, but he loves his botany quite as much.

Every region has peculiarities in its flora, which, I suspect, might teach us something of the ancient geology and geography of the country; and although we cannot, like the Rugby, Dudley, and Shrewsbury Societies, go to the top of the Wrekin to see the plants there which seem to be looking wistfully to their relatives far away on the hills of Wales, or the more distant Scotch hills, yet there may be mosses and plants about our marshes and ditches which might teach us something of the history of far-gone-by times, and lead us to distant countries as well as distant ages. Then our conchologists have to work out their vein of investigation, and in holiday times, could we not get into connection with the dredgers on our shores, or even establish a little dredging ourselves? Many an important topic, both of marine botany and marine

conchology, might thus be investigated, and we might occasionally dredge up some old bone or tooth that even Mr. Gunn would not despise. I merely suggest these things as objects we might have in view. Our northern seas have not yet been properly dredged and it strikes me, there is much yet lying in them for us, if by any contrivance we could get them dredged.

We are likely to have one or two more entomologists, and we have the late Mr. Brightwell's collection open to us: and, perhaps, some of our friends may be able to get tropical insects or descriptions of them for us. Our Society may not only be interesting but useful, if we bring entomological knowledge to bear on agriculture, as botany has been brought to bear on it. There are many insects that are nuisances to the farmers, and, perhaps, we might be able to do something that might be practically useful. We shall also have one or two ornithologists; and we ought to know a great deal more minutely about the migration of birds. Mr. Stevenson has done a great deal, but we shall want it broken down into small bits for us to digest at our leisure. There again our conservative principle must come in, and we must set our faces against the perpetual gunning and destruction of birds throughout the land. It is possible that we may have to bring some facts and some papers upon the subject of excessive preservation of game and its results—of course, only as naturalists—and upon the diseases thereby produced, and even its effects on the farming interest. If we have a member or two who are large land-owners and game preservers, I shall be happy to help them in getting up a discussion, not upon the holy crocodile or ibis of Egypt, but upon the holy pheasant and sacred partridge of present times.

In all these ways there seems to be plenty of work laid out for us. There is a great interest rising up in all departments of natural history, and all departments of science.

In regard to the question of origin of species, upon which Mr. Wallace has given us certain information, there is the light thrown upon it by fancy domesticated animals. We have the canary, pigeons, sheep, and cattle, and it strikes me we might get papers and even facts that might be of great interest; and I don't see why we should not take our share in the great battle of species. We might get some honourable wounds, or might come out with honourable spurs, but that battle is going on and must be fought out; and

therefore, if we can have some discussion on the subject our Society will be all the more animated, and possibly we might add a little to the progress of science in this particular.

Then as to fish, we have a capital river, besides the broads, and I do not know any spot in the country, till you go to the lakes, where ichthyology could be better studied.

Then as to expeditions, we propose next month to go over to see the Scoulton gulls; or to Horstead, either with or without our geological friends. Those expeditions, I hope, will present great variety of interest. We have one feature which does not occur, I believe, amongst the geologists—we have admitted the ladies amongst us, not out of compliment or flattery, nor yet upon the principle of Miss Lydia Becker, but I do hope they will attend, and that we will get information and co-operation from them, and that we shall have them accompanying us on our expeditions.

I have laid before you what seems to me a rough sketch of the various lines in which our Society may direct its efforts. Professor Huxley told us the other day that all naturalists are, by character and by nature, huntsmen. I believe Huxley is right. All naturalists and lovers of nature are in some degree inspired with a love of hunting. It is a glorious excitement and a glorious pursuit, only let us remember that we are students, and that it takes many facts to make a truth—many facts must be gathered together into your crucible, and the fire of patient investigation applied to them, before you get the little shining globule of truth.

We shall require the assistance of the members of all parts of our Society; we shall require careful, patient help, and hard work, which is the work most healthy, most exciting, and most uniting. The work done by our fathers and predecessors will be useful to us, but we shall have to verify it and take nothing upon trust, and we must also try to get some new facts for ourselves. The works we study are the works of Him to whom nothing is small and nothing too large—nothing so great but that it is made up of what is small, minute, and infinitesimal.

II.

ON THE DIVISION OF THE COUNTY FOR BOTANICAL
PURPOSES.

BY HERBERT D. GELDART.

Read April 27th, 1869.

OUR secretary has asked me to address a few words to you to-night, and I do so very willingly, as by so doing I gain the opportunity of bringing before you a point of order and method in studying the natural history of our county, which I think of considerable importance; and, if I may be allowed to say so, I am quite certain that on the amount of method that we infuse into our proceedings will depend our usefulness and success as a society, or, at any rate, the amount of influence which we shall bring to bear upon the progress of systematic science, and I need hardly say that I do not regard desultory unsystematic scientific observations as of any use whatever. In fact, method is to the man of science what discipline is to the soldier—without method a man of science is a mere dabbler, who gets in both his own and other people's way and hinders what he hopes to forward—just as armed men, who know neither their duty nor their places, become but a mob, more dangerous to each other than to anyone else. I take it for granted that the formation of full and correct lists of the species of every branch of natural history indigenous to or occurring in the county will form no inconsiderable part of the objects of our society, and I am anxious that the lists so formed should be not only records of the mere occurrence of an individual species within the limits of the county, but also a fair index of the comparative rarity and extent of distribution of that species throughout its area.

In order to do this it is necessary to divide the county into districts, and to bring the full weight of the society to bear upon the subject, it will be necessary that all the members should adopt the same divisions, as otherwise a list made by one member will require translation, or, at all events transcription, before it can be

compared with that of another member who has chosen a different plan of dividing the county; and, if possible, it would be very desirable for the society to adopt a definite division as the basis of its local lists.

Now, there are two ways of making such a division of any given space. The first and best, where it can be used, is to take advantage of natural boundaries, such as ranges of hills or rivers, which may make an actual difference of position, or of condition in the portions divided. The second is to make a purely arbitrary or artificial division, which shall merely map out the area into convenient districts, with as much regard to difference of character in those districts as may be attainable.

The first of these two ways is unfortunately impossible in our own county—there are no great rivers or leading lines of hills that can be taken advantage of for its division, and we are of necessity obliged to fall back upon purely arbitrary divisions.

The system of division which I propose that the society should adopt was originated by the Rev. George Munford, in his list of plants found in Norfolk, published in *White's Directory*. He thus describes it:—"To mark the distribution of species throughout the county I have divided it into four parts, and shall briefly mention the prevailing strata of each part as we proceed.

"First.—The eastern division (marked E in the map)* whose western side has for its boundary an imaginary line running north and south from Cromer to a little east of Harleston. This division contains the alluvium of the valleys of the Yare, the Bure, and the Waveney; the blue clay which occupies the higher ground of the same valleys, next to which we meet with the larger part of the crag formation, and then a small portion of the upper chalk at the south-western corner of the division.

"Second.—The central division, separated into northern central (marked N.C. in the map); and Third, southern central (marked S.C. in the map) by an imaginary line running east and west from Norwich to Swaffham, both having for their western boundary another imaginary line, passing north and south from Brancaster to two or three miles west of Thetford. These divisions, with the exception of the north-east corner, which is crag, lie entirely on the upper and medial chalk formations.

* The map referred to was produced at the meeting.

“Fourth.—The western division (marked W. on the map) which comprises all that remains of the county, and contains geological features of a much more varied kind. Thus the north-east corner is occupied by a small portion of the medial chalk, to which succeeds a belt of the hard chalk, running from Hunstanton to the banks of the Little Ouse, then follows a narrower belt of the chalk marl, succeeded by about the same width of greensand or carstone, and the series ends with a very narrow line of Kimmeridge clay and Oolite, which runs from Heacham until it nearly reaches the Wissey. The extreme west of the county is occupied by the alluvium of Marshland and of the valleys of the Ouse, the Wissey, and the Nar.”

This is Mr. Munford's account of his divisions, but I think the main characteristics of them may be summed up very shortly. The eastern division contains the whole of the broad country; the western the whole of the fen country, and the central divisions consist entirely of the high land lying between those two districts.

I have myself made use of these divisions in keeping my own list of the Flora of the county, and am quite satisfied with them. The main objections I expect to find raised against them is that they are too few, but I think this is the right side on which to err; and as an example of much greater sub-division of a county, and, if I may venture to say so, of excess of sub-division, I have here Professor Babington's map of Cambridgeshire, in which that county, though only two-fifths of the size of Norfolk, is cut up into eight divisions, each numbered and named after the principal place within it; in this case we must remember that the division is immensely aided by the rivers and drains which intersect the county, most of the boundaries of the districts being formed by them.

There is one other point of method to which I beg to call your attention—it is the absolute necessity in all lists of using the authority after the specific name. As a proof of this we need go no further down the list of plants than the genus *Viola*, in which the species “*canina*” used without authority means, according to the third edition of *English Botany*, at least three different plants, viz. :—

V. canina L. = *Sylvatica* Fries, and includes subspec. *Riviniana* Reich.

V. canina Bab.=*Pumila* Vill, and includes *flavicornis* Sm. which is "*canina*" of many authors.

The omission of authorities, in fact, renders any list of species entirely useless and leads to endless confusion.

After a discussion, the division of the county, as suggested in Mr. Geldart's paper, was adopted by the Society for botanical purposes, and the thanks of the meeting voted to Mr. Geldart for his paper.

III.

STRAY NOTES ON NORFOLK AND SUFFOLK MAMMALIA.

By J. H. GURNEY, F.Z.S.

Read 25th May, 1869.

HIGH-FLYING BAT (*Vespertilio noctula*.) This bat, so far as I have observed, always inhabits hollow trees rather than buildings. I have found it usually in old hollow ash. When the females have young, they form numerous colonies, in which, I believe, there are no males; the females, if then disturbed, will fly out with their young ones clinging to them; the males live at that season by themselves in much smaller communities. These bats, about half an hour before commencing their evening flight, keep up a continuous chirping, which may be heard by a person walking under the trees which they inhabit. It would be interesting to ascertain whether the sexes continue in separate communities throughout the year.

PIPISTRELLE BAT (*Vespertilio pipistrellus*.) Gregarious by day in roofs of buildings, under leads, &c., but never, so far as I know, in trees. It would be curious to ascertain whether the sexes in this bat also form separate communities.

LONG-EARED BAT (*Plecotus auritus*.) I believe this bat also frequents buildings, and occasionally hollow trees, but it is less gregarious than the Pipistrelle.

BARBASTELLE BAT* (*Barbastellus daubentonii*.) I once captured a single specimen under the bark of a pollard oak at Easton ; and am informed that it has been several times captured in the neighbourhood of Beccles.

It would be interesting to ascertain what other species of bat occur in Norfolk.

PINE MARTEN (*Martes abietum*.) BEECH MARTEN (*Martes foina*.) During the latter part of the last century "Marten Cats" existed in Brooke Wood, as I was informed by an old woodman, now deceased, who was employed there in that capacity in his youth.

If my recollection does not deceive me, the late Jehoshaphat Postle, Esq., of Colney, had in his collection a stuffed Norfolk specimen of the marten.

It is probably impossible now to ascertain to which of the two races of marten found in Great Britain those which formerly inhabited Norfolk belonged.

STOAT (*Mustela erminea*.) A gamekeeper at Northrepps having missed some pheasant's eggs from a nest on the top of a bank next a plantation, watched the place, and observed a stoat take an egg out of the nest, and carry it without breaking it along the top of the bank to its hole several yards off: the hole was dug out, and in it were found all the other missing eggs unbroken, except a slight puncture made by the stoat's teeth in carrying them to its hole.

The stoat is called "lobster" in Norfolk—a name which, it has been suggested, may have been originally "leapster," and given to it from its habit of progressing by a succession of leaps or bounds. The stoat frequently becomes white in Norfolk during the winter months, as it always does in the Arctic regions.

WEASEL (*Mustela vulgaris*.) The difference of size in the sexes of this animal is very remarkable; the females, which are much smaller than the males, are called "mouse-hunters" in Norfolk.

A female weasel was once seen at Earham in the act of attacking a half-grown rabbit, by biting it behind the ear; both animals

* I am indebted for valuable information respecting this and some other species, of which I have availed myself, to the kindness of Mr. Crowfoot, of Beccles.

were killed at one shot, and stuffed in the attitude in which they were observed before the shot was fired.

OTTER (*Lutra vulgaris*.) The tracks of otters are frequently to be seen in the snow in winter on the banks of rivers which they frequent. Otters are said in Norfolk to fish up stream when they go out on their nocturnal expeditions, and to return down stream to their sleeping places. They often travel many miles in the night, and I recollect one being traced by its tracks in the snow from Wrampingham to Eaton; it had pursued the windings of the Yare during the whole distance, but frequently landing and running along the bank, had made the tracks which were thus followed.

I once traced an otter on a snowy morning in February from Earlham to Keswick, when its retreat was discovered under the floor of a bathing house, and the otter was shot after being turned out from its retreat by a dog. It proved a female, and as it had evidently given suck, its retreat was examined, and a single young one was found in a small nest composed of ivy leaves. The foundling was suckled by a bitch which had lost her pups, and progressed very well till it was about half-grown, when an attempt was made to wean it, which proved unsuccessful, and the otter (which had become very tame) sickened and died.

Otters often leave the neighbourhood of the water during their rambles, especially when crossing from one stream to the other. In the parish of Easton, they were in the habit of thus crossing from the Yare to the Tudd, and from the Tudd to the Wensum; and I knew two instances of otters being captured on high ground at Easton, apparently whilst performing such journeys.

During a hard winter many years since, a large male otter attacked and killed a sheep in a field at a considerable distance from any stream, at Briston, in Norfolk; and a man who brought some turnips to the flock, found the otter regaling itself on its victim, and killed it with the tail-board of the tumbril in which he had brought the turnips to the sheep. Otters do not exclusively frequent secluded localities. I once saw a female and her young, which had been captured under the floor of a bathing house at Heigham, and the late Mr. Horton once found and killed an otter in his dyeing yard in Norwich, adjoining the Wensum. I once saw two otters, nearly full-grown, which were found together

(both drowned) in a bow-net set for pike at the mouth of a meadow drain opening into the Yare at Cringleford.

BADGER (*Meles taxus*.) The badger I suppose to be nearly extinct in Norfolk. A fine specimen was captured about ten years since at Intwood, being dug out of its burrow in a plantation in that parish; and in 1868 a badger was trapped at Somerton, which dragged the trap to a distance of four miles, where it was found dead in a sheep-fold, with the trap fastened to one of its legs.

HEDGEHOG (*Erinaceus europæus*.) The hedgehog appears to hunt by scent. I once saw a hedgehog caught by the nose in a gamekeeper's steel trap, the bait being a piece of carrion on the top of a stick about twelve inches high, which was stuck upright in the ground near the trap. I once knew a Scotch terrier which was indefatigable in hunting for hedgehogs, though it could never be induced to pay any attention to rats, rabbits, or any other object of pursuit, except the hedgehog.

COMMON MOLE (*Talpa vulgaris*.) The late Mr. James Dix, of Tivetshall, had a spaniel that constantly accompanied him in his morning walks over his farm, which he was in the habit of making at a very early hour. This dog was always on the look out for the working of the moles during the early morning, and when he saw the surface mould being moved by a mole, would plunge his muzzle into the soil, and seldom, if ever, failed to secure the mole, which it seemed to be the dog's especial delight thus to capture.

WATER SHREW (*Sorex fodiens*.) I never saw a Norfolk specimen of this shrew, but I once saw one from Oulton, near Lowestoft.

POOLED SHREW (*Sorex remifer*.) I have met with this species at Keswick and at Stoke Holy Cross. When it is playing on the surface of a pond in a summer evening, it exhibits a degree of activity which is perfectly marvellous. I am informed that this species has also occurred at Gillingham and at Fakenham.

COMMON SHREW (*Sorex araneus*.) Many years ago I saw a very small shrew swimming in a marsh inside the sea bank on the Cley side of Salthouse marshes. I succeeded in capturing it, and sent it to the late Mr. Yarrell, who pronounced it to be a specimen of the common shrew; but I have always had some doubts of the identification being correct, and mention the circumstance as one

which may suggest further investigation. It is well known that shrews attack and devour frogs, and the late Mr. John Edwards, of Stoke Holy Cross, informed me that he was once a witness of such a combat. It is remarkable that though cats will not eat shrews, they are constantly devoured by the barn owl.

BANK VOLE (*Arvicola pratensis*.) I am not sure that this vole occurs in Norfolk; but I once saw a vole which was taken from a kestrel's nest at Earlham, and which appeared to me at the time, on a cursory examination, to belong to this species, rather than to its commoner congener, the short-tailed vole, and I therefore think the point of whether this is really a Norfolk species or not, worthy of further investigation.

HARVEST MOUSE (*Mus messorius*.) I have met with this somewhat local species at Catton, and I have been informed that its nest has been taken two or three times amongst tall sedges, on the banks of the Waveney, opposite Beccles. These nests were of the usual globular form, and were almost entirely composed of the leaf of the reed (*arundo phragmites*.)

THE HARE (*Lepus timidus*.) Grey varieties of the common hare have been occasionally killed in Norfolk, also specimens of the ordinary colour, with the face white; but a still scarcer and more remarkable variety is a perfectly black hare, which was killed at Denham, in Suffolk, and is in the possession of Sir E. C. Kerrison, Bart.

RABBIT (*Lepus cuniculus*.) Black rabbits have occasionally occurred in the neighbourhood of Cromer, and they are also to be found, amongst those of the ordinary colour, on Corton Denes, near Lowestoft, where I once shot one which was decorated with alternate black and grey markings like a cyprus cat.

Black rabbits appear to have existed anciently in Norfolk, as they are mentioned in one of the Paston letters, where the writer applies to a friend for some rabbits to turn down for stock at Oxnead. This curious letter also refers to the practice of warrcners hanging up *in terrorem* the vermin which they killed—a prototype of the modern “gamekeeper's gibbet.”

The above very desultory notes on a few of the Norfolk Mammalia may perhaps be of some little service as indicating points worthy of further investigation, and have been committed to paper in the hope that such may prove to be the case.

IV.

ON THE LARVA OF AN UNKNOWN LEPIDOPTEROUS
INSECT, FOUND IN THE BARLEY CROP OF 1868.

BY C. G. BARRETT.

Read June 29th, 1869.

DURING the past winter my attention has been much directed to the ravages of some insect in barley. The last year's crop of that grain was, in consequence of the great heat of the season, exceedingly hard and heavy, as well as plump and full; but in the process of malting, some of these large plump grains were observed to decay, and become mouldy, instead of germinating; to float on the surface of the water in the cistern, or even to be blown out with the light grains and rubbish by the blowing machine. These grains were found, on examination, to be perforated at the upper end, and bored through their entire length, but not entirely emptied. An experienced brewer and maltster in this city, who was the first to point them out to me, assured me that the mischief was not the work of the corn weevil (*Sitophilus granarius*), with the ravages of which he was well acquainted; that this insect, when it attacked a grain, usually cleared it out, leaving only the husk, and that it did its work in the granaries during the winter and spring. The grain in question, however, had never been stored, but was brought to the malt-house directly on being threshed. It appears obvious, therefore, that this mischief was done either in the field or in the stack, and this will account for the fact that the perforation is in every instance at the upper end of the grain, and not at that which was attached to the ear. In most of these hollowed grains I find the perforation empty, evidently from the entrance being so wide that any frass would be readily shaken out, but a few still contain the excrement of, to all appearance, a Lepidopterous larva, and in two instances I was so fortunate as to find a dead and shrivelled larva, evidently Lepid-

opterous, but not recognisable, while in other grains portions of exceedingly delicate pupa skins have occurred, in some cases doubtful, but in others showing unmistakably the two anal points found only in some of the Diptera.

The difficulty, therefore, becomes complicated, since there are distinct indications of two different insects, belonging to different orders. That one assailant may be a small moth one can easily understand, but it is very difficult to comprehend how a Dipterous larva (footless) of the family Tipulidæ, to which the pupa skins appear to belong, can manage to eat out the hard substance of a grain of barley, and the supposition that it might have been done while the grain is soft, is disposed of by the plump soundness of the grain and the condition of the remaining farinaceous substance.

That the Dipterous insect can be a parasite on the larva of the Lepidopterous, is hardly possible, since such a habit does not seem to be known among the Tipulidæ, and the really parasitic Diptera, such as *Musca*, form a perfectly amorphous pupa. All the Dipterous pests of grain yet known, as I am informed, such as the Hessian fly, attack the grain when in blossom, and destroy fructification by laying their eggs in the corolla of flower, or else by boring into the stem and causing it to wither. Specimens of the injured grains, which I have submitted to Mr. Rye, the well-known Coleopterist, have been carefully examined by him, and although he enumerates no less than eight species of beetles which feed on grain, he came to the conclusion, before the dead larva or pupa skins were discovered, that the offender was not Coleopterous. He moreover very kindly examined works on the subject by Kirby and Spence, Westwood, Kollar, and Hagen, and some of Curtis's papers, but without obtaining any light upon this subject. If the grain had laid in the granary it would have been possible that the larva of *Tinea granella*, a small moth, had done the mischief; but in this case there would almost certainly be galleries of silk joining the grains together, and they would be gnawed indifferently from either end. Moreover, *Tinea granella*, as far as I am aware, seldom or never attacks grain in the field or the stack.

Gelchia cerealella, another minute moth, on the other hand, is, I believe, a field-feeder, and possibly may be the culprit in this case, but I have been unable to ascertain exactly its mode of feeding. It is reported as a great pest on the continent, but is in

this country fortunately so rare that its occurrence would be a matter of great interest to Lepidopterists. In conclusion, I may say that every sample of barley which I have examined during the past autumn and winter has contained the injured grains, so that the pest, whatever it is, would seem to have become common all at once in this part of the country ; and I, therefore, am anxious to induce those who have the opportunity, to carefully examine the barley crops towards next harvest, that we may, if possible, elucidate the history of this new enemy or enemies, and ascertain whether there is any possibility of checking the mischief—and to that end any information obtained will be very acceptable to me.

V.

ON THE STUDY OF ENTOMOLOGY.

BY W. M. CROWFOOT.

Read January 29th, 1869.

MR. PRESIDENT, LADIES, AND GENTLEMEN,

I feel that the short paper which I am about to read to you requires a word of apology from me. When requested by your President to assist him during his year of office, by contributing a paper, I told him at once that I feared my various engagements would not give me time to make any original observations, and that, therefore, he must not expect any new and hitherto unrevealed facts from me. All indeed that I could promise to lay before this Society was a few suggestions as to the prosecution of a special branch of natural history, to which I have myself paid a little attention, viz.—entomology, and at the commencement of a Society like the present, I thought that possibly some few hints as to what appear to me to be the most important objects of entomological study would be acceptable to the junior Members, and as it is for them that my remarks are especially intended I must crave the indulgence of any experienced entomologists who may be present this evening. I shall not take up your time by describing the apparatus required, or the methods to be adopted for capturing and preserving

insects, as these can be learnt from any text book, but I would rather point out those paths of research which may be most profitably followed, by those who intend to devote themselves to this branch of natural history. At the risk of appearing somewhat pedantic, I shall divide the work of the entomologist into three portions, according as it has reference to the anatomy, the physiology, or the zoology of insects, and under each of these three heads I will make a few remarks.

The anatomy of insects is a most interesting study, but as it must mainly be conducted with the assistance of the microscope, papers on this subject would perhaps more properly be read before the microscopic society. I shall therefore not enter at all upon this branch of the study, but would simply remind young entomologists, that it is absolutely necessary that they should have some knowledge of the structure of insects, in order that they may understand the distinctions between the different orders, families, genera, and species, and be able to describe correctly any new caterpillars or perfect insect which they may be fortunate enough to meet with.

By the physiology of insects I mean the study of their lives, and the mode of action of the complex mechanism of their bodies, and to this subject I would particularly direct the attention of my hearers. Up to a very recent period British entomologists had paid but very little attention to the life histories of insects; the eggs, larvæ, and chrysalides of a great number of even our commonest Lepidoptera were quite unknown in this country, and descriptions and figures of the caterpillars were copied from the works of foreign observers. During the last few years, however, much has been done, especially in working out the life histories of the few insects, and a portion of this work, at least will I hope, be accomplished by Members of this Society. There are many advantages to be derived from this pursuit. In the first place it encourages habits of close and careful observation, for it should be remembered that no scientific truth is so trivial or unimportant as to be unworthy of observation, and it is remarkable on what very slight physiological causes very important practical results are sometimes dependent. In the second place it tends to prevent the entomologist from degenerating into a mere collector. There is always a fear lest we should forget that the great end to be kept in view is to add to

scientific knowledge, and not merely to fill our cabinets with beautiful objects. Lastly, by breeding insects from the egg, and thus working out their life histories, we are in little danger of exterminating a rare species, but on the contrary are rather tending to its preservation, as by care and attention a much larger number of individuals may be reared from a given batch of eggs, than would in a state of nature have come to maturity, owing to the protection which in confinement is afforded them against their many natural enemies.

When breeding insects it is desirable to keep a register, and make notes of such circumstances as the position of the eggs, the habits of the caterpillar, the time of hatching, &c., for these apparently trivial points are sometimes found to have an important practical bearing. Thus *e.g.* there are two closely allied species of moths, *Bombyx cynthia* and *Bombyx paphia*, each of which produces a kind of silk. They are inhabitants of India and China, and are largely cultivated for the sake of their produce. *Bombyx cynthia* breeds readily in confinement, and judging by analogy, we should have said that *Bombyx paphia* would have done the same, but it will be found on experiment, that the males of *Bombyx paphia* are so wild that they cannot be tamed, and consequently will not breed when confined. This necessitates an entirely different treatment for these two species, apparently so closely allied by nature, *Bombyx paphia* is always kept in the open jungle, and all attempts to make it breed in confinement have as yet been unsuccessful. *Bombyx cynthia* on the other hand may easily be reared in ordinary breeding cages.

The notice of these moths leads me to mention another point well worthy of the attention of the entomological members of this Society, viz., the study of the silk-producing insects. Owing to the disease which has of late years prevailed so extensively amongst the silkworms of southern Europe, the silk crop has been very seriously affected, and the French government appointed a very able entomologist, M. Gurein Méneville, to introduce into Europe, and acclimatize, if possible, new and hardy species of silk-producing insects. He introduced thirteen new species, and of these, two, viz., *Bombyx cynthia* and *Bombyx ricini*, appear to be thoroughly acclimatized in France. These insects are inhabitants of India and Northern China. The remaining eleven species have

been brought—two from India, three from America, one from Japan, two from China, one from Australia, and two from French colonies. Amongst English entomologists, Dr. Wallace has devoted especial attention to this subject, and he will, I know, be most happy to give information to anyone wishing to take it up. My own experience has been but very limited. I find that *Bombyx cynthia* may readily be reared in common breeding cages. With the Japanese worm, *Bombyx yamamai*, I have not been so successful, as all my larva died last year, but I am trying it again this season, and hope to have better luck. It seems, however, to be much more delicate than *Bombyx cynthia*. Of *Bombyx paphia*, the insect which produces the Tusseh silk, I obtained a single female from six chrysalises sent from India in 1866. From this source I was of course unable to secure a brood, and a large number of chrysalises which I received the following year, were unfortunately injured on the passage, and therefore did not hatch.

Independently of the stimulus afforded by the hope of adding a really useful number to our native fauna, these insects are so beautiful and interesting both in the larva and the perfect condition, that their study will amply repay the trouble bestowed upon them. Coming under this physiological section of my paper, there are so many subjects which I hope will engage the attention of members of this Society, that I can only enumerate two or three more.

Intimately connected with the breeding of insects are the observations which have been made on the effects of different kinds of food in the larva state on the perfect insect, as for instance, the production, by feeding the larva on certain plants, of dark varieties of *Amphydasis betularia*, (the pepper moth,) and *Arctia caja*, (the tiger moth,) also the effect of heat and cold on the retardation or acceleration of the pupa stage, and the size of the perfect insect, of which the hot summer of 1868, afforded some remarkable instances. One occurred to myself. I captured a specimen of the common *Pieris napi*, or green-veined white, so small, that at first sight I thought I had got some rare species. It measures only 1 inch 2 lines across the wings, whereas, the ordinary measurement of this insect is 1 inch 7, to 1 inch 11 lines.

I observe, that several similar cases have been recorded lately, and are doubtless to be accounted for partly by insufficiency of food for the larva owing to the drought, and partly from heat

having so rapidly forced the insects through the pupa stage, that they had, so to speak, no time to attain their natural size.

These and kindred subjects derive a special interest from their bearing on the great question of the origin of species. Another obscure subject requiring much investigation is the periodical appearance of certain insects. Last year afforded numerous instances of this fact. To a certain extent every insect is more or less periodical in its appearance, and I have frequently remarked, in particular seasons, the almost complete absence of what are generally common species. I believe it will be found, on examination, that a special and different reason for its periodicity exists in the case of each individual species, and it is only by carefully studying its life history that we can hope to ascertain this cause. Thus, for instance, an unusually late frost in May may destroy entire broods of young caterpillars, especially if they be in a delicate state from having recently moulted, or in the case of diurnal Lepidoptera a few wet days occurring shortly after they have emerged from the chrysalis, may effectually prevent the union of the sexes and consequently the impregnation of the eggs.

I must leave this wide field of physiological entomology, and glance briefly at a few of the points comprised in the last division of my subject, zoological entomology, which will probably after all demand the greatest amount of attention from the entomological members of this Society. One of their first duties, I imagine, will be to complete, as far as possible, the collection in the museum, and I would suggest that a register, similar to the one recently published by Mr. Carrington, of York, showing the locality, date of capture, captor's name, &c. be kept with it. The occurrence of species new to the county will of course be recorded and the specimens exhibited. The formation of thoroughly authentic local lists, from which I hope in time a complete insect fauna of the county may be compiled, is highly desirable. The mapping out of the distribution of different species is a subject which should be especially studied, as it may assist us in solving some of the difficult questions connected with the distribution of species generally. Many insects are almost as much confined to certain localities as plants. Thus *e.g.* I discovered that very local species, *Arge galathea*, in 1864, confined to a single marsh in the parish of Kirby Cane; the next year it was just as local but it had changed its quarters, having migrated to a contiguous marsh. The

following year it had shifted again to a third locality, and now for the last two years it has either disappeared altogether, or chosen a locality which I have not been able to discover. Other species again show just the reverse tendency, instead of being confined to one spot, they turn up singly under very different circumstances, and in very different places. Moreover the widely distributed species are not such as we should expect. I have been much struck in comparing Indian with European Lepidoptera, to find, that with the exception of the painted lady (*Cynthia cardui*) which seems to be a cosmopolite, and *Danais chrysippus*, there is scarcely one amongst the active and quick flying *Rhopalocerae* that is common to the two continents. On the other hand amongst the *Sphingidæ*, many of which are very sluggish insects, I find two species of *Acherontia*, (Death's Head Moth) scarcely to be distinguished from the European one, while the Indian specimens of *Sphinx convolvuli*, *Chærocampa nerii*, *Chærocampa celerio*, and *Macroglossa stellatarum* seem to be identical with the European ones. I think that by a careful study of the distribution of insects over a limited area, we shall be more likely to understand facts like these than in any other way, for in all natural phenomena the laws which regulate those of minor consequence and of more limited prevalence, govern those also which have a greater importance and a more extended influence.

Practically speaking, I think that the Lepidoptera of Norfolk at least may be divided, according to the localities they frequent, into five groups :—

1st. The marsh species. These, of course, are more particularly to be sought for amongst the broads of East Norfolk, and deserve particular attention, as there are many amongst them whose life histories are not as yet known, and which are scarcely to be found elsewhere in England. -

2nd. The heath-loving species. These are also well represented in Norfolk, and amongst them is a small group of species, including *Lithostege nivcaria*, *Acidalia rubricata*, and *Agrophila sulphuralis*, which seem to be limited to a narrow strip of country on the borders of Norfolk and Suffolk, in the neighbourhood of Thetford and Brandon. These insects, and the cause of their narrow limits, require investigation.

3rd. The coast insects. These are found chiefly on the flat,

sandy portions of the coast on the marrams. The lighthouses form most productive traps for these species, and many varieties may be obtained from them. Another method for taking the night flying coast insects during the day, is to kick the tufts of marram grass, by which means the noctnæ which conceal themselves amongst the roots during the day, may be dislodged.

4th. Forest insects. These, I think, will scarcely be found so numerous in Norfolk as in the neighbouring county of Suffolk. *Apatura iris*, *Limenitis sibylla*, and the large fritillary, *Argynnis paphia*, have not, I believe, as yet been recorded as taken in Norfolk; but I hope that by diligent search they will be found, as I have met with two out of these three fine species within a couple of miles of the border of the county. Possibly the rarity of any very old woods in Norfolk may account for the absence of these and other forest species, as I believe that insects will generally be found to be amongst the oldest inhabitants of a district.

5th and lastly, there is a group of insects which are found generally in the neighbourhood of cultivated ground, in hedgerows, fields, &c. These, of course, are abundant in almost all parts of the county. Amongst them are some which deserve to be studied—not on account of their rarity or their beauty—but on account of the injury which they cause to the crops, and for the sake of devising, if possible, measures to check their ravages.

Of these five groups of lepidoptera, the marsh species are undoubtedly those which are most characteristic of Norfolk, and which possess most interest in the eyes of collectors. Owing to the alterations produced by drainage, these species are fast disappearing from every other part of England, and it is incumbent on the Norfolk entomologists to work out the life histories of many of them, before they become, like most of the fen birds, altogether things of the past. There are, I believe, generally one or two men who come down during the summer for the special purpose of collecting these marsh insects for sale; and I know from the intercourse which I have had with some of these entomologists, how much practical and interesting knowledge of the habits of their prey they possess, and I hope that this Society may be the means of inducing these men to come forward and communicate their knowledge for the benefit of entomologists at large.

In the few remarks on the study of entomology which I have just made, I have purposely derived all my illustrations from the Lepidoptera alone, because it is only with this order that I have any practical acquaintance, but I should be sorry on this account to have it supposed that I would ignore the work to be done in the other Orders of insects. On the contrary, it is just those branches of the science which have received the least attention, which require the more, and from the little experience I have myself had and the results already recorded, I feel sure that Norfolk will prove a rich collecting ground both for the Coleopterist and the Hymenopterist, and I believe that those who will breed and collect the Phryganidæ or caddis-flies, will discover many points of interest in their life histories, and be able to add several new species to the British list.

Such, Gentlemen, is a very cursory glance at the work which lies before the Norfolk entomologists; and, in conclusion, I would sincerely congratulate you on the formation of a Society like that to which this paper is addressed, and which I doubt not will afford most efficient aid and stimulus in carrying it out.

VI.

ON THE MERES OF WRETHAM HEATH.

BY HENRY STEVENSON, F.L.S.

Read August 24th, 1869.

ON the 8th of August, 1869, in company with Mr. John Ringer, of West Harling, I visited the three Meres on Wretham heath, which, from time immemorial, have been the natural watering places of the cattle and sheep depastured in that wild country; and which, like oases in the desert, delight the eye with their unlooked for and refreshing waters. Crossing a portion of Roudham heath, we drove for some distance along the "Pedder's Way," one of the oldest roads in the kingdom, and turning to the left, past the level crossing of the Great Eastern Railway, we entered upon Wretham heath, near the junction of the Watton extension with

the main line. Here, following the "drove" road, as it is termed, though scarcely more suited for locomotion than the surrounding heath, with its mole-hills and rabbit holes, we drove on till the old Thetford road crossed our path at right angles, and following this to the left for a short distance, found *Ringmere* on the right, backed by a small plantation of Scotch Firs, forming, with an adjacent enclosure, a sheltering spot for the sheep that are here washed and watered. At the present time this Mere is not much more extensive than a large pond, round, as its name implies, with sloping margins, bordered with furze which plainly mark the full extent of the pool in wet seasons. A short soft turf, quite firm enough to drive upon, covers the sloping sides; but at the upper end is a beautiful white sand. This Mere, which is pretty deep in places, has no other vegetation on its banks than a small patch or two of rushes, and its only denizens appeared to be two couples of Dabchicks or Little Grebes, which played "heads and tails" after their manner, as long as we stood to watch them.

Retracing our steps to the "drove" road, we passed on to *Langmere*, about three quarters of a mile further, the site of which, on the right hand side, is indicated from some distance by a rising ground, crowned with fir-trees, which, tradition says, were not planted by the hand of man. In former years, when Langmere was about three times its present extent, this grassy knoll, with its ancient timber, was almost an island, the waters surrounding it in all but one spot which left a track-way wide enough for stock to be driven in at night, and folded as it were within this natural inclosure. Now, the long water, from whence it derives its name, is contracted within much narrower limits; and one or two detached ponds or pulk holes, in front of the island, with soft turfy margins sloping down to the water, and bordered at their furthest outline with a fringe of furze bushes, assist the eye to trace out the normal extent of this large fresh water basin.

On climbing the mound, to get a view of the main water, several wild Turtle-doves fled from the fir-trees, and the rattle of their wings spread a panic amongst the wild fowl which, with their young ones were scattered over the Mere. At the first sight of a stranger, for they seemed to care little for a shepherd and his flock, some ten or twenty couples of duck and mallard rose from the water, and circling round, made off no doubt for the more secluded

waters of the Great and West Mere on Mr. Birch's estate. The mallards, as usual at this season, were distinguishable only by their notes, having assumed for a time the duck's plumage. Many flappers, about half grown, and some, quite nestlings, were being escorted by anxious parents amongst the sheltering rushes; and with the aid of a glass I distinguished a female Shoveller duck, a species which occasionally nests on our Broads, and which from her nervous actions, had, I don't doubt, good cause for alarm, in a little brood close by. Two or three couples of Dabchicks, and a flock of Lapwings, busily feeding on the opposite shore, completed the picture, and a very pretty sight it was, with a bright gleam of sunshine bringing out distinctly the different tints of their plumage.

About a mile further on, and still keeping to the "drove" road, we came last of all to *Foulmere*, also on our right; but here, charming as is the aspect of this wide expanse of water, with its small green islets and thick belt of rushes at the further end, there is an absence of that utter wildness of character which marks the other two. Beyond the Mere the gables of a farm-house, barn, and cottages, accounted for the absence of the wild duck and mallard. On one side a flourishing crop of "golden grain," fenced in and grown on the reclaimed soil, and on the other, within a wide area of turf walls, a splendid crop of turnips, marked the inroads of the plough, and the changes which still threaten the wildest spots in this agricultural county. On this fine Mere, though, like the others, showing evidences of having extended far beyond its present borders, I saw several couples of Coots and one small pair of ducks, which I believe to have been Garganey-teal, a species which is accustomed to breed on our Broads and inland waters. The Little Grebe, however, seemed the *genus loci* as I counted no less than thirty, and nearly all old birds in full summer plumage, so that their young were probably hiding in the rushes. Good perch have been caught in this Mere, and the water is extremely deep in places. A rising ground on the right, as at Langmere, is covered with firs, but whether planted or self-sown I am unable to say. Bleak, however, as a large portion of this extensive heath land still remains, one can scarcely realize its lonesome wildness before the necessities of sheep farming led to the formation of enclosures, here and there, thickly planted with firs and other hardy trees, to screen the flocks from the biting winds

Before also, with a like object, though at the same time subserving the picturesque, the rising grounds were planted as well, and cultivation, as at Foulmere, seemed, with a magic power, to make a garden smile in the wilderness.

Of the true origin of these and other Meres in this county I am unfortunately not geologist enough to give a satisfactory opinion; but when on the spot I gleaned certain facts respecting them which will not, I think, be uninteresting to those who may be able to explain their nature and formation far better than I can.

All these Meres lie within the Parish of Wretham, as well as the Great and West Meres on Mr. Birch's estate. At Ringmere, probably from its adjoining the various boundaries, no less than seven parishes have the right of watering sheep, viz:—Kilverstone, Croxton, East and West Wretham, Bridgham, Roundham, and Brettenham; and the importance, therefore, of that supply, in such a district, can scarcely be over-rated. In former days so much interest was taken in this one pool that, about harvest time, many people would come from long distances, to see whether the waters of Ringmere were high or low, these pilgrimages having a special reference to the price of corn. If Ringmere was full the price of wheat would go up; but would fall with the fall of its waters. As a guide to the prospects of a wet or dry season, these auguries taken from the Ringmere basin were no doubt correct; but the agricultural visitors to this watery oracle must have been sadly depressed, when in 1859, they found the entire Mere dry as the surrounding heath. In that summer Mr. Ringer walked across it in all directions, and a hole dug in the middle, about four feet deep, supplied no water. It is a singular fact, however, that a small pit hole, which was dug out some fifty yards from the basin of the Mere, and close to the Thetford road, was soon filled with water, and supplied all the sheep throughout that season. Mr. S. Gayford, of Wretham, who had this pit made, and which was full of water when I saw it, had also another made in the enclosure, on the further side of the Mere, on rising ground, and here also water was found, although the Mere remained perfectly dry. On the other hand, in some wet seasons, the waters of Ringmere have not only filled the basin but have flowed over the road, till horses could stand knee deep, and then, flooding the level heath, have been known to extend themselves for nearly three miles, down to the Roud-

ham houses. In that same summer of 1859, Langmere was quite dry, and Foulmere consisted only of a small pond at the further end of the basin, and on all other portions was a flourishing crop of wheat, oats, and vetches, when visited by Mr. Ringer and his farm steward; the vetches not doing well were mown, and cow-cabbages sown in their place. This was the first occasion that either of my informants had known such an event within their time; but each assured me that their fathers had often spoken of a tradition that Foulmere was once dry, and that a crop of oats then grown upon it was lost by the sudden influx of the waters, too rapidly for any portion of the grain to be cut or carried. In the hot summer, of 1868, the waters were very low in all the three Meres, but never dry. I have more than once heard it asserted that these Meres have never covered so large an area since the late Mr. Birch, at the cost of several thousand pounds, drained his West Mere in 1851, and Great Mere in 1856; but if the above-mentioned tradition be true, and there seems no reason to doubt it, since the same thing occurred in 1859, it is evident these Meres have dried up from other causes than drainage, and long before Mr. Birch's explorations were ever thought of. In conclusion I may add, in evidence of the antiquity of these waters, that in West Mere, with about eight feet of mud, and in Great Mere, with not less than twenty feet in some places, Mr. Birch discovered hundreds of bones, consisting almost entirely of the Red Deer (*Cervus elephas*) and the now extinct *Bos longifrons* but amongst these was a goat's skull, and the skull of a boar or pig. A still more remarkable fact, however, was the discovery in that neighbourhood, for the first time in the British Islands, of the remains of comparatively recent specimens of the European Fresh-water Tortoise (*Emys lutaria*). All these bones, which, as before stated, were found under a great depth of mud, were associated with the remains of "pile buildings," resembling the ancient *lacustrine* habitations of Switzerland, and the water dwellings still used by the inhabitants of Borneo. In those pre-historic ages, then, we may presume that this vast heath district was inhabited by wild tribes, living on the products of the chase, and the finny spoils of their home waters.

Did the Great Bustard then wander, in large "droves," over the yet unplanted waste, with the Ox and Red Deer of those early times, to descend, even to our own days, as the last representative of

a vanished fauna? Speculation would run rampant with such a theme, and having adduced only such facts as I can personally vouch for, I will not seek to detain you with mere suppositions, perhaps as wild and unproductive as Wretham heath itself.

VII.

ON THE FLIGHT OF BIRDS.

BY THOMAS SOUTHWELL.

Read 30th November, 1869.

THE paper to which I beg your attention this evening is devoted to a subject of very great interest, but also one, the difficulty of which, renders it incumbent on me to offer an apology for presuming to approach it; I must also, for the same reason, beg your kind indulgence if occasionally I do not succeed in making myself so clearly understood as I should wish to do.

In introducing the "Flight of Birds" to the Norfolk and Norwich Naturalists' Society, I can claim very little originality for what I have to say on the subject, I have simply endeavoured to put, in as condensed a form as possible, all the reliable information which has occurred to me in my readings on the subject of flight, interspersed with such observations as have come under my notice in those Ornithological pursuits which have formed rather the amusement than the scientific study of my leisure hours; the result will, I trust, have some interest if not much originality.

The chief object of this paper is that of inducing the Members of this Society to give the phenomenon to which it refers, the attention it merits, to induce them to observe and record their observations, and I know of no branch of Natural History regarding which there is such a paucity of original records, nor is there one perhaps, taking it in all its bearings, which leaves more problems to solve.

Of all the faculties possessed by animals, the most remarkable, and until recently, the least understood, is that of *flight*. Surely nothing but long familiarity with this astonishing power could cause

us to regard it with anything approaching indifference. The seeming impossibility of a heavy body supporting itself in mid-air, and with graceful and rapid motion gliding along, changing its direction at will, apparently violating all the known forces of nature, is sufficiently astonishing to attract the attention, and engage the researches of scientific men—and yet, till of late, this subject has been neglected or the theories formed to account for so remarkable a phenomenon, have been altogether erroneous.

In attempting to ascertain the means by which a bird is enabled to rise into the air, it has been the custom to regard its weight as the chief impediment, and the great stumbling-block to the arrival at the truth seems to have been the very natural idea that *buoyancy* was the first essential to flight, this however is now clearly shown not to be the case, so far from being an essential, too great a degree of buoyancy is an actual impediment, and weight is found in reality to be the very main-spring of flight. When Hunter discovered the presence of air-cells in the bones, and dispersed over various parts of the bird's body, it was believed that by means of inflating these cavities with heated air, it was possible to increase its *bulk*, and at the same time decrease its *weight*; unfortunately however, additional bulk without a corresponding increase of weight (as will be shown presently) would only enlarge the surface presented to atmospheric resistance, rendering the too buoyant body of the bird a helpless object, the sport of every changing current of air with which it came in contact. If, as Sir Charles Bell* says, "it is necessary that birds as they are buoyed in the air, be specifically lighter," and this is to be accomplished by inflation with hot air, let us see what the result would be. Captain Hutton, in a most interesting paper "on the Birds inhabiting the Southern Ocean," printed in the "Ibis," for 1865, (to which I shall have occasion to refer more than once) has given an admirable account of the flight of the albatross, and very clearly pointed out the mechanical principles by which it is effected. He there shows that in order to bring the specific gravity of the albatross to that of the atmosphere, the air-cells in its body should contain 1,820 cubic feet of air, heated to 108 degrees—equal to a sphere of more than 15 feet in diameter; "or, in other words, they must be 1,200 times the size of the body itself of the bird," which he adds would give it, when flying, an Aldermanic appearance he

* Bridgewater Treatise on the Hand, p. 72.

has never observed. M. de Lucy calculates that a bird the size of a raven, in order to render itself as light as the air, must increase its dimensions to about a cubic metre, or 35 feet 547 cubic inches. It is obvious therefore that the air-cells which are so largely dispersed over the body and in the bones of the bird, are not intended to enable it to render itself lighter than the air, which would in fact reduce it to utter helplessness. Without doubt, however, the air-cells are of immense importance in many ways, the greatest of which, perhaps, is that of aiding respiration; they also form an admirable contrivance for maintaining the temperature of the body, and by their presence in the bones, give lightness to the skeleton without taking from its strength. Probably there are many other useful purposes served by the air-cells, some of which have been hinted at but are not clearly understood.

In another place Sir Charles Bell says, "it is remarkable how small an addition to their body will prevent them rising on the wing," and further tells us that birds are oviparous, because they never could have risen on the wing, when with young, had they been viviparous. This would certainly have been true had the hot air theory been the correct one, but I do not think we find it to be the case; the pelican and heron carry home heavy loads of fish to their young, and the larger birds of prey rise with considerable weights in their talons, the smaller ones with weights in proportion. The flying mammals are viviparous, and the bat not only carries its young during gestation, but also attached to its breasts during their babyhood, and that without apparent inconvenience in flight. We must therefore, I think, seek some other reasons for birds being created oviparous, reasons which I have no doubt will be found to apply equally to the oviparous reptiles, and to be altogether independent of the faculty of flight. It is a mistake to suppose the bird possessed only of sufficient powers of flight just to enable it to sustain and direct itself in its passage through the air, for we know circumstances in its chequered life often require the display of exertions immensely superior to those required for the mere ordinary purposes of flight—now cradled by the wind, which bears it along its way without the slightest exertion—anon, laboriously beating up against a gale, which it taxes its utmost powers to succeed in making way against—always pursuing or pursued, its safety and sustenance depend upon its swiftness and power of endurance. The vulture,

instanced by Sir Charles Bell, and which he tells us the difference of a full meal is sufficient to *out-weight*, and prevent from rising until it has disgorged, probably owes its helpless condition to quite another cause, namely the stupor attendant upon repletion, more or less observable in all birds of prey, and not the mere weight of its meal.

Of late years the possibility of man being enabled to navigate the air by means of suitable machinery, has been seriously discussed by many men of undoubted learning and ability, particularly in France, and, as might have been expected, their attention has been given in the first instance, to the study of the laws which govern the flight of animals, and the mechanical principles involved. The late Duke of Argyle was engaged for many years in studying the same subject, and his son has given us the result of his investigations in a masterly chapter on flight, in "The Reign of Law." Thanks to the patient and careful investigations of modern scientific men, "The way of an eagle in the air" is no longer a mystery—its wonderful powers can be dissected, as it were, and the various contending forces called into action, to produce the phenomenon of flight, examined separately—strange as it may appear at first sight, we shall find it to be *weight*, and not buoyancy, which forms the motive power.

M. de Lucy, a French Doctor of Medicine, has written an elaborate paper, "On the Flight of Birds, of Bats, and of Insects, in reference to the subject of Aërial Locomotion," (a translation of which has been made by Dr. Fox, of Scarborough,) in which he has shown that three great properties are absolutely essential to all winged animals: First, *weight*—or the force of gravity. Second, *surface*—or the area presented to atmospheric resistance; and third, *force*—or the power of projection inherent in the animal, and exercised by it. On each of these it will be necessary to dwell a short time, in order thoroughly to understand them.

1st. *Weight*, or gravity. "The idea of a weight, even very light, suspended and moving itself in the air without any apparent support—without the least supporting material—seems so little in accordance with the daily experience of men, that we do not willingly admit the fact of the bird possessing weight."* No wonder that so simple a solution of the difficulty, as what may be called the hot-air theory, was universally accepted; but a little

* De Lucy, "Flight of Birds," &c., paragraph iv.

thought will show how erroneous is the conclusion. Without weight the object would be helpless, it might *float*, but it could never *fly*; there would be no resisting force to form a fulcrum to its movements; it would in fact be part of the atmosphere, and subject to it, wafted hither and thither without the means of guiding itself or directing its motions. "No bird," says the Duke of Argyll, "is ever for an instant of time lighter than the air in which it flies; but being on the contrary always greatly heavier, it keeps possession of a force capable of supplying momentum, and therefore capable of overcoming any lesser force, such as the ordinary resistance of the atmosphere and even of heavy gales of wind." * The bird being elevated in the air possesses, in virtue of its weight, a force, always exerting itself in a downward direction, thereby producing *motion*, which if it has the power to control, will prove the mainspring of its flight.

2nd. In order to counteract this downward force, the next property is called into request—viz., *Surface*. The expanded wing of the bird is presented to the column of air perpendicular to itself, and a new law of nature comes into operation—that of atmospheric resistance. This is not sufficient to counteract the force of gravity without some mechanical action on the part of the bird, but it would in a great measure break the force of the fall, causing it to descend in a series of zig-zags, as a sheet of paper falls from a balloon, or rooks descend from a great height to their roosting trees. Although in a vacuum the force of gravity is absolute, and all bodies of an equal mass fall through a given space in precisely the same period of time, and with a velocity which increases with the square of the time, yet, through the resistance of the air, all bodies passing through it are light in proportion to their surface, and "every body, whatever its absolute weight or bulk is, may become, in the air, as light as a feather, by a simple alteration of its form;" † a bird, therefore, which with closed wings would come to the ground with great force and increasing rapidity, by simply expanding its wings, so as to increase the surface offered to the resistance of the atmosphere, in a great measure overcomes the action of the well known force of gravitation. We should expect to find the surface increase in due proportion to the weight of the animal to be supported in the air, but strange to say,

* "Reign of Law," page 130.

† De Lucey, paragraph iii.

it has been shown by M. de Lucy that the extent of surface is always in an inverse ratio to the weight of the winged animal; the heavier the animal, the smaller its wing surface referred to a fixed standard—this is seen remarkably in flying insects—the body is very light, but the wing surface enormous.

3rd. The bird is now in mid-air, but the force of gravity would soon bring it down, notwithstanding the parachute-like surface of its expanded wings spread out to the resistance of the air—were not some other action brought into play to overcome the balance of gravity. This is the third property, *Force*, or the muscular power of depressing the expanded wing, forcibly, and rapidly, so as to cause the elastic column of air beneath to rebound with sufficient force to destroy the remaining effects of gravity, and so to equalize all the forces, as to leave the bird, which we have chosen as our illustration, ready to pursue its course at will.

Before proceeding to consider the principal forms of progression and the mode in which each is accomplished, it will be as well to glance at the mechanism by means of which the result is brought about.

The first thing which strikes us on examining the skeleton of a bird, is its great lightness combined with strength. The bones are thin and hard, not filled with marrow as in the terrestrial animals, but cellular in their interior and filled with air; the broad surfaces for the attachment of the muscles are evidence of great muscular power, and the consolidation of the vertibræ of the back indicates firmness and solidity. The neck and extremity of the tail are free, but in the whole trunk there is great firmness and compactness. The bones forming the shoulder girdle are particularly strong and well knit. The whole purpose of this beautiful arrangement is to give power to the wings.

In wingless birds the keel of the sternum is altogether wanting, but in birds of strong flight it is very conspicuous; the depth and extent of this ridge indicate the development of the pectoral muscles which here find attachment; two of these muscles (the 1st and 3rd) produce the powerful downstroke of the wing, the other (the 2nd) is the elevator. So immensely are these muscles developed, that according to Borelli they out-weigh all the other muscles of a bird's body taken together, whilst in a man they are but a 70th part of the whole mass of muscles.

The furculum (consisting of the clavicles ankylosed together at their mesial extremities,) the coracoid bones and scapulars, all converge on either side at the shoulder, and form the point of articulation for the bones of the wings; the furculum acts as a spring to prevent the wings from striking too far up or down, and thus flapping against each other, above the back or under the belly; the coracoid bones are stays to the force of the pectoral muscles, and the scapulars, imbedded in the muscles of the back, tend to brace the dorsal and sternal portions of the skeleton together with firmness and elasticity. The bones of the wing are the same as those of our own arm and hand, with some modification, and the action of the elbow-joint, being only in one direction, when the wing is extended, it presents an inflexible surface during the downward stroke. To the bones corresponding to our hand, the primaries, or great quill-feathers are attached; to the fore-arm (ulna and radius) the secondaries and wing coverts, and the tertials and scapulars to the larger bone or humerus. I will not stop to speak of the beauty of form and structure of the feathers with which this wing is furnished, except so far as is necessary in endeavouring to show how this wonderful apparatus is made available for the purpose for which it was constructed.

The front part of the wing, that first presented to the air in forward flight, is stiff and unyielding, well adapted for cutting its way through the air—at the extremity of the wing are placed the large quill-feathers, or primaries; they are very strong and rigid, and bear the chief burden of the flight; the other feathers become weaker and more pliable, as they are placed nearer to the body of the bird, each feather strongest at the point of insertion, and becoming more and more yielding towards its extremity; the whole so set as to be parallel with the body of the bird when flying, the points directed to the rear. These feathers, which are divided into two portions by a nearly central shaft, overlap each other, the anterior web, which is the stronger and stiffer, being uppermost: when, therefore, the down-stroke is delivered, the wing presents to the air beneath it an impenetrable and unyielding surface, but when the corresponding up-stroke is made the yielding posterior web of each feather becomes depressed by the resistance of the air above, thus separating the feathers so as to allow of the free passage of the air—by this means giving the maximum amount of force to

the down-strokes, which but for this contrivance would be neutralized by the resistance of the up-stroke. In addition to this, the under-surface of the wing is more or less concave, whilst the upper surface is in a corresponding degree convex; it is obvious, therefore, that when the up-stroke is made the air will rush *off* and *through* the wing in all directions, but when the motion of the wing is reversed, the air will be gathered up in its hollow and the resistance immensely increased. We can thus easily understand how it is that the *depressing* power of the up-stroke is as nothing compared with the *elevating* power of the down-stroke.

The action of the wing which we have just described, would only enable the bird to ascend perpendicularly, and a separate motion would seem to be required to enable it to proceed in a forward direction—this, however, is not the case, for, by a wonderful contrivance, the same stroke which elevates the bird, gives it a forward motion also. The mode in which this is effected is thus described by the Duke of Argyle:—"The air, which is struck and compressed in the hollow of the wing, being unable to escape *through* the wing, owing to the closing upward of the feathers against each other; and being also unable to escape *forwards*, owing to the rigidity of the bones and of the quills in that direction, finds its easiest escape *backwards*. In passing backwards, it lifts by its force the elastic ends of the feathers; and thus, whilst effecting this escape, in obedience to the law of action and reaction, it communicates, in its passage along the whole line of both wings, a corresponding push forwards to the body of the bird. By this elaborate mechanical contrivance, the same volume of air is made to perform the double duty of yielding pressure enough to sustain the bird's weight against the force of gravity, and also of communicating to it a forward impulse. The bird, therefore, has nothing to do but to repeat, with the requisite velocity and strength, its perpendicular blows upon the air, and by virtue of the structure of its wings, the same blow both sustains and propels it."*

The form of the wing varies very greatly, and determines the velocity and style of flight of its owner. Those birds, with very long and pointed wings, possess the greatest powers of flight, as for instance, the sharp-winged merlin for speed, and the long-winged

* "Reign of Law," 5th edition, pp. 138, 139.

albatross both for speed and endurance. The latter seems to fly without the slightest effort, and never to tire. The swift is another example of graceful and rapid flight—the longest summer's day, from dawn till dusk, seems too short to tire it—high up in the air, it looks like the birds we used to draw at school—one dark line for the body, the rest all wings. The rounded wing indicates diminished power and a more laborious style of flight. The partridge flies with great rapidity, due to the momentum imparted to its heavy body by the rapid strokes of its short powerful wings, but it possesses none of the airy elegance of its long-winged brethren, and continues its flight no longer than is necessary to change its feeding ground or secure its safety.*

Again, the wing of the divers is reduced to the smallest dimensions compatible with flying at all, and is as useful for progression under-water as through the air—it, in fact, serves two purposes, and in two different elements—in the air as a wing, and in the water as a fin. The penguins are incapable of flight, but use the wing with great effect in diving; the same may be said of the great auk, a bird formerly found in the northern seas, but now probably extinct. As might be expected, the wing of the diving birds is specially adapted to their mode of life; the quill feathers are short and stiff, and in the species just mentioned, it is reduced to a mere paddle to aid progression under water. The same gradations may be traced in the land birds, from the long-winged kite to the wingless apterix. With the exception of those few which are unable to sustain themselves in the air, the divers fly with great velocity, the wings being worked with extreme rapidity by very powerful muscles, but they are possessed of very little facility of evolution, flying straight to and from their feeding

* What has been said with regard to weight, and the form of the wing in birds, applies equally to insects. The hawk moths have very large bodies, broadest at the thorax, the abdomen stout but tapering, the wings are long, narrow, and pointed, and their flight direct and rapid almost beyond conception. The flight of the cabbage butterfly, with its thin, light body, and large, rounded wings, is feeble and uncertain in the extreme—it has evidently too much canvas for the ballast it carries. On looking at a box of insects recently, I was struck with the position in which the wings of one or two humming-bird hawk moths were set; the position was precisely that which would be assumed for the purpose of *hovering*—a style of flight for which this beautiful insect is so celebrated.

grounds—rising with difficulty and alighting with a splash. Compare these with another class of ocean feeders, the gulls and terns, which take their food generally on the wing; nothing can be more graceful and rapid than the flight of these birds—the beautiful little terns stopping in their rapid flight in a moment, and dashing headlong into the sea to secure their prey.

The equilibrium of the bird is maintained by the relative position of the wings and the heaviest parts of the body—the wings being placed above, and close to, the centre of gravity, the heavy body of the bird serving as ballast to keep it always in one position, and as a fly-wheel to store up and regulate the momentum acquired by the action of the wings.

Having, by repeated flappings of the wings, raised itself into the air, and acquired a certain degree of momentum, many birds possess the power of “sailing,” or continuing their course without motion of the wing, for a considerable length of time. The most wonderful example of this mode of flight is the albatross. “I have watched them by the hour,” says Major Holland,* “in the strong trade winds off the Cape of Good Hope, when the ship has been reeling and staggering before the driving gale, making thirteen knots, with no sail but a close-reefed fore and main topsail, shoot by her like a swift arrow, passing about a mile a-head and then just turning on one side, without a flap of the wing, they rose some 200 feet, and swooped past again, against a breeze which the anemometer showed was travelling at twenty-six to thirty miles an hour.”

Captain Hutton, in the article before quoted,† says, “never have I seen anything to equal the ease and grace of this bird [the albatross] as he sweeps past, often within a few yards, every part of his body perfectly motionless, except the head and eye, which turn slowly and seem to take notice of everything. I have sometimes watched narrowly one of these birds sailing and wheeling about in all directions, for more than an hour, without seeing the slightest movement of the wings. This is, however, longer than usual.” In order to perform this seemingly difficult feat of “sailing,” the bird first acquires, by means of its wings, a certain degree of momentum, it then, by combining the pressure of the air against its wings, with the force of gravity, according to the laws of mechanics, as we have described before, is enabled to sail

* In a letter to the writer.

† “Ibis,” 1865, p. 294.

in any direction it pleases, so long as the momentum lasts. "If when sailing against the wind, the inclination of the body is such that the upward pressure of the wind against his wings and body just balances the force of gravity, his momentum alone acts, and he sails straight in the 'winds eye.' If he wishes to ascend, he inclines his body more to the horizon by means of his head and tail."*

There is still another feat performed by some birds, requiring greater skill, and power of wing more wonderful, even, than that just described, if we bear in mind the direct *forward* impulse given at every stroke of the wing in ordinary flight. This is the power of "hovering," or remaining suspended in the air without progressing—hung like a speck in the clouds, as we often see the kestrel when hunting over the fields in search of its prey. The mode in which this is accomplished, is thus graphically described by the Duke of Argyll:—"Of course, if a bird, by altering the axis of its own body, can direct its wing-stroke in some degree *forwards*, it will have the effect of stopping instead of promoting progression. But in order to do this, it must have a superabundance of sustaining force, because some of this force is sacrificed when the stroke is off the perpendicular. Hence it follows, that birds so heavy as to require the whole action of their wings to sustain them at all, can never afford this sacrifice of the sustaining force, and, except for the purpose of arresting their flight, can never strike except directly downwards—that is, directly against the opposing force of gravity. But birds with superabundant power, and long sharp wings, have nothing to do but diminish the length of stroke, and direct it off the perpendicular, at such an angle as will bring all the forces bearing upon their body to an exact balance, and they will then remain stationary at a fixed point in the air.

"They are greatly assisted in this beautiful evolution by an adverse current of air; and it will always be observed, that the kestrel, when hovering, turns *his head to wind*, and hangs his whole body at a greater or less angle to the plane of the horizon. When there is no wind, or very little, the sustaining force is kept up by a short, rapid action of the pinions, and the long tail is spread out like a fan, to assist in stopping any tendency to onward motion. When there is a strong breeze, no flapping is required at all—the force of the wind supplying the whole force necessary to

* Ibis, 1865, p. 296.

counteract the force of gravity; and in proportion to the increasing strength of the wind, the amount of vane which must be exposed to it becomes less and less. I have seen a kestrel stand suspended in a half-gale, with the wings folded close to the body, and with no visible muscular motion whatever. And so nice is the adjustment of position which is requisite to produce this exact balance of all the forces bearing on the bird, that the change in that position which again instantly results in a forward motion, is very often almost insensible to the eye. It is generally a slight expansion of the wings, and a very slight change in the axis of the body.”*

In order to turn when on the wing, a bird does not shorten the stroke of one wing and exercise the other with greater violence, as we should do with the oars of a boat, to produce the same effect, nor does it use its tail as a rudder, or the swift, which has a very small tail, but great facility of evolution, would be unable to pursue its circling flight—but it appears to be the result of an involuntary effort of the bird, as we turn or incline to the right or left in walking; the wing on the inside of the curve is depressed, and that on the outside elevated, to a corresponding degree, and in proportion to the sharpness of the curve. Captain Hutton says, the albatross turns in this way when soaring, the wings remaining rigid the whole time, and sometimes depressed to such an extent as to be almost perpendicular to the sea; and this inclination of the wings is *always* seen when the bird is turning, but at no other time. The same may be constantly observed in the swift. The tail having no lateral motion, could have little or nothing to do with the change of direction. The chief uses of the tail appear to be, the additional surface it enables the bird to present for its support in the air—to assist it in rising or falling by its upward or downward deflection; it also, doubtless, assists the bird in stopping or slowing itself, and in maintaining its general equilibrium.

The rapidity with which the wing strokes follow each other in a strong flying bird is enormous; so rapid are they, that in many birds it is impossible to follow them with the eye. The Duke of Argyll says, the heron, which is remarkable for its slow and heavy flight, flaps its wings no less than 120 to 150 times in a minute; counting both the up and down strokes, there are 240 to 300 separate movements per minute. But this is as nothing compared

* “Reign of Law,” pp. 160—2.

with the rapidity of some birds. Try to count the pulsations of the wing of a kingfisher, or of the short-winged puffin—it will be found not only impossible to count them, but the wing itself will become blurred, or lost to the vision, in consequence of its rapid motion.

It is a matter of considerable difficulty to obtain reliable data as to the actual velocity with which birds travel through the air, the speed acquired, however, is certainly very great. Professor Owen mentions the historical falcon belonging to Henry the Fourth of France, which flew from Fontainebleau to Malta, a distance of 1350 miles in one day, and remarks that “the flight of a hawk, when its powers are fully exerted, is calculated at about 150 miles an hour.” He also tells us the eider duck’s usual flight has been estimated at the rate of 90 miles an hour.* Audubon estimates the flight of the American passenger pigeon at a mile a minute. Pigeons, he tells us, have been killed in the neighbourhood of New York, with their crops full of rice, which they could not have collected nearer than the rice-fields of Georgia and Carolina. “As their power of digestion is so great that they decompose food entirely in twelve hours, they must in that case have travelled between three and four hundred miles in six hours, which shows their speed to be at an average of about one mile in a minute.” Hearn says, “the trumpeter swan going down wind in a brisk gale, cannot fly at a less rate than 100 miles an hour.”† The well-known instinct which prompts the carrier pigeon to return to its home immediately upon being set at liberty, should it be carried to a distance, has been made use of from very early times to convey intelligence. Two thousand years ago, according to Diodorus Siculus, they were used for this purpose; more recently, five hundred years ago, the Turks sent intelligence by relays of pigeons, (Stanley), and even now the Electric Telegraph has not quite driven them off the road, although it has robbed their occupation of its usefulness, and left nothing but the sporting element; in the present day they are generally sent up from race-courses, the birds being matched against each other for speed. Never having myself witnessed the wonderful way in which the bird proceeds to ascertain the direction it must take in order to reach its home, I will

* Todd’s “Cyclopædia of Anatomy, ‘Aves,’” p. 298.

† “Broderip Zoo. Recreations,” p. 145.

quote a letter, in which Major Holland has kindly described it to me: "In my early days," he writes, "I was accustomed to see carrier pigeons sent up from Goodwood to London, (about 50 miles, 62 by road), six used to be sent in each flight; they were started from the top of a lofty hill some 600 feet above the sea-level, and on a clear day, the Thames (*i.e.* the glitter of the water in the sun) could be made out from the hill with a glass. I have often timed them—they generally were from twelve to twenty minutes 'towering up,'—*i.e.*, wheeling round and up in a spiral directly over the trap; they rose in this way till nearly out of sight, and then (apparently catching sight of their destination) they make straight for it with a swoop like a hawk 'stooping' on its prey: the news they conveyed was invariably received within the hour, so, deducting the time occupied in 'towering' and catching them on arrival, they were probably not more than thirty minutes, or perhaps twenty in traversing the 50 miles." It will be seen that only an approximate idea of the bird's speed can be obtained from the duration of these matches; indeed, the actual speed seems to be one only of the many qualities necessary to make a first-rate carrier; it must mount rapidly and decidedly, commencing its "bee-line" homewards as soon as it has towered high enough, and alight freely upon its arrival at its home, as the time is reckoned from leaving the trap to the delivery of the despatch. Major Holland suggests that in order to ascertain really the rate at which the carrier flies, it should be observed at some match the second at which the first good "clear headed, decided" bird makes his unmistakable swoop right away, and have the time taken carefully when he first comes in sight at his destination, (not waiting for him to light, which he will not do till he has circled once or twice around, as though to check his speed,) and "the intervening time will give the true speed of flight." I hope this will be done by some person who has the opportunity. Amongst the recent flights, I have observed the following recorded in the newspapers:—

FROM		About Miles.	Minutes occupied.
Chichester.....	} to London	60	87
Newmarket		60	78
Ditto		60	85
Brighton		51	75
Romford		12	13½

The last was said to be a very slow flight. Supposing the first four birds to have occupied half the time assigned to them, in starting and alighting, as it seems probable they would, then their average speed would be 85 miles per hour. Many remarkable instances of pigeon flights are on record. Rennie ("Faculties of Birds") mentions one from Paris to Cologne in two hours and five minutes, at the rate of nearly 150 miles per hour. Bishop Stanley records the flight of a pigeon to a part of Holland, 300 miles distant, in five hours and three-quarters, at the rate of above 50 miles an hour, supposing the bird lost not a moment and proceeded in a straight line, which is not likely. Yarrell (vol. ii, p. 296, 2nd Edition) also mentions a number of birds sent up from London, the first of which arrived at Antwerp, a distance of about 240 miles in five hours. But the most wonderful instance with which I am acquainted, is recorded by Mr. Yarrell, in the preface to the second supplement to his "History of British Birds." Mr. Yarrell quotes a letter written to him by Sir John Richardson, in which he says:—

"With respect to Sir John Ross's pigeons, as far as I can recollect, he despatched a young pair on the 6th or 7th of October, 1850, from Assistance Bay, a little to the west of Wellington Sound, and on the 13th of October a pigeon made its appearance at the dove cot in Ayrshire, from whence Sir John had the two pairs of pigeons which he took out. The distance direct between the two places is about 2000 miles." Well may Mr. Yarrell add, "by what extraordinary power did this interesting bird find its way, and by what route did it come?"

Major Holland estimates the flight of rooks "going home to bed, with full stomachs, and taking it easy," at about 26 to 30 miles an hour; the speed of the albatross, in its swoop past the ship in company with which it is cruising, he reckons at about 90 miles an hour, "perhaps rather more than less." The swallow, Bishop Stanley computes at 90 miles, and the swift, when dashing in headlong flight round the old church tower, chasing its companions in sportive flight, Mr. Strickland* believes to fly at the rate of from 130 or 140 miles per hour. The wood-pigeon flies, according to the same authority, from 90 to 140 miles in the hour, and the rock-dove even more than this. But superior to all,—inasmuch as

* *Field*, 10th March, 1866.

their very existence demands that they should be swifter on the wing than the birds on which they prey—are the falcons. An eagle in the Pyrenees, Bishop Stanley tells us, was timed crossing a valley, and found to be going little short of 140 miles an hour. Audubon says, “the fishing eagle of America dashes down upon its prey with such rapidity as to cause a rushing sound like a violent gust of wind amongst trees, and that its fall can scarcely be followed by the eye.” In the *Field*, for March 10th, 1866, Mr. W. J. Strickland says, “I have not the slightest hesitation in saying that I believe the peregrine falcon is capable of attaining a speed of from 150 to 160 miles an hour. Let those who are incredulous draw their conclusions from actual observation, and not from what they consider possible. Certainly, I never saw any object move with such intense velocity through the air as the peregrine in his death rush, and the depth with which the body of the pigeon or partridge is frequently ripped up, strongly corroborates the impression which my sight has conveyed.” “Peregrine,” well-known in the Naturalists’ column of the *Field*, writing on the same subject, thus concludes:—“And yet 150 or 160 miles an hour, or rather at that rate, is a wonderful pace; and it is difficult to conceive any creature with lungs, living through it. Think of the express as it flashes by the station, with just a clatter and confusion of windows! It is gone; but its pace is not *half* that which we have just given to the peregrine. *And to much more than DOUBLE* the speed of the express! Very well; but I can hardly as yet believe in anything faster than 150 miles an hour. In that, however, I *do* believe.” Difficult as it may be to ascertain the exact speed with which birds wing their way through the air, there can be no doubt that they are capable of attaining an immense velocity, and I do not think “Peregrine” has over-rated the flight of his favourite falcon.

This power of passing with ease and rapidity over long distances is of vast importance to birds living in communities; rooks for instance would soon exhaust the supply of food in their own neighbourhood, we find therefore where they muster strong they always go some miles from their home to feed. Herons go long distances in search of food, and these birds, as well as rooks may be seen high in the air returning to their roosting places, their lofty flight and direct course indicating the journey to be a long one

Mr. Stevenson tells me he is satisfied the guillemots and gulls seen feeding in Yarmouth and Lowestoft roads during the breeding season, come from the great nesting places on the Yorkshire coast, and Mr. Yarrell * states, on the authority of Dr. Jenner and Rev. Nathaniel Thornbury, that the domestic pigeons about the Hague, "make daily marauding excursions, at certain seasons of the year, to the opposite shore of Norfolk, to feed on vetches, a distance of forty leagues."

Sir Thomas Browne, whose keen observation nothing escaped, speculated in his "Hawks and Falconry" on the "swiftness of the hawk," and "the measure of their flight" . . . and adds, "how far the hawks, merlins, and wild fowl, which come unto us with a north-west wind, in the autumn, fly in a day, there is no clear account, but, coming over the sea, their flight had been long or very speedy. For I have known them to light so weary on the coast, that many have been taken with dogs, and some knocked down with staves and stones."† We are not much better informed on this subject now than we were two hundred years ago, when Sir Thomas Browne penned the above observations; the exhausted birds still arrive on the coast, and after a brief rest to recruit themselves, disperse inland, but whence they come, and by what route, the scraps of evidence we possess, only enable us to guess. Our subject is *flight*, not migration, and I must only touch upon the latter so far as it serves to illustrate the immense power of enduring protracted flight, possessed even by some of the weakest of our land birds; but that many of our little spring migrants *can* endure the fatigue of such a flight as they must make to reach our shores, is too wonderful to believe, were it not placed beyond all doubt that they do undertake such flights, from the fact of their having been captured on board ships, far from any land. That the albatross should follow a ship for many days in succession, or that the Cape pigeon should be known to have done the same for a distance of 1500 miles, or that the same giant petrel (*Procellaria gigantea*) for three weeks, should hover about the vessel in which Mr. Gould was sailing,‡ is sufficiently astonishing, even allowing them an occasional rest on the surface of the water. But what shall we say to the great tit (*Parus major*), 920

* Vol. 2, p. 292, second edition.

† Sir Thomas Browne's Works, tract v, vol. iv, p. 189, Wilkin's edition.

‡ "Ibis," 1865, p. 292.

miles from land, or the tit-lark, 1300 miles on the one side from the nearest main land of South America, and on the other, 900 miles from the Island of Georgia! Both these instances however, are recorded by Bishop Stanley,* the former on the authority of Foster's North America, and the latter on that of Dr. Traill, who saw the interesting little wanderer at Liverpool, where it was conveyed by the ship on board which it was taken. Thompson, in his "Natural History of Ireland" † gives an interesting account of a flock (or it may be flocks) of snowy owls, which for several days followed a ship on her voyage from Quebec to Belfast, in November, 1838. The ship's "log-book" states that thirty or forty were seen on the 16th November; on the 17th a few alighted on the masts, and two were captured; on the 18th, fifty or sixty flying about and alighting on the rigging; 19th and 20th, owls seen both days and two more captured; on the 21st, a gannet and a curlew were seen, but the owls appeared no more. "The vessel was about 250 miles from the Straits of Bellisle, the south-east point of Labrador, when these owls first appeared, but sailing eastward, was, on the day they were last seen, about 740 miles distant thence, and 480 miles from the southern extremity of Greenland, which, for some time, was the nearest land." From the birds appearing and disappearing at uncertain intervals, and in fluctuating numbers, Mr. Thompson is of opinion, the same individuals did not present themselves on each occasion, but that they were successive flocks migrating to more southern latitudes. The captain of the vessel describes the appearance of these splendid birds, hovering in silent flight around his ship in mid-sea, as beautiful in the extreme. Many other instances of the extraordinary powers possessed by birds to endure protracted flight, are on record, but these well authenticated examples are quite sufficient for the purpose of showing how wonderful is the power which enables creatures, so delicate, and apparently so feeble as our little summer migrants, to obey the mysterious instincts of nature which urge them to face all the dangers of an adverse element, and wing their way from distant climes; returning, in some cases, almost to the day, to the land of their birth, to fill our groves with melody, and labour ceaselessly for our benefit.

I have endeavoured, hurriedly, and I fear imperfectly, to show

* Familiar History British Birds, vol i, p. 94, third edition.

† Vol i, pp. 102—6.

how the opposing forces of gravity, and the resistance of the atmosphere—the first represented by the *weight* of the bird, exerting a constant downward influence ; the second being made available by the *surface* presented to its action by the open wings of the bird, and forming the fulcrum against which the mechanical force of the wing stroke is directed—how these two forces, equalized by the *vital force* of the bird, form the resisting media which enable it by muscular action to mount into the air. I have next tried to explain briefly, the wonderful mechanism by which the wing is worked, the construction of the wing and its various forms, some of the principal forms of progression, and the mode in which each is accomplished, and, finally, have ventured a few remarks on the speed acquired by birds, and their power of sustained flight.

In conclusion, I cannot help expressing the wonder and admiration with which this display of the wisdom of the Allwise Creator fills my mind, and, I doubt not, the mind of everyone present ; how great the contrast between the silent and mighty working of natures unchanging laws and the puny efforts of man, who with all his boasted skill, has not yet been able to construct a machine to enable him to navigate the air, and even with the bird before his eyes has failed to learn its lesson.

VIII.

MISCELLANEOUS NOTES AND OBSERVATIONS.

AQUILA CRYSÆTUS, *Golden Eagle*.—The first authentic instance, to my knowledge, of the appearance of the Golden Eagle in Norfolk occurred in November, 1868, under the following circumstances :—The bird was found dead in the Stiffkey Marshes, by a fisherman named Green, who communicated the fact to Mr. T. J. Mann, my informant, who happened to be shooting in that neighbourhood. That gentleman carefully examined the bird as it lay, but finding it too much decomposed for preservation, secured the sternum and feet, from which the species was readily identified. From an examination of one of the feet and from Mr. Mann's

description of the plumage of this bird, I have no doubt that it was an adult male, and judging from the locality in which it was found—close to the sea—it was most probably the victim of a random shot, and died almost as soon as it reached the shore.

CRUS CINEREA, *Crane*.—The spring of 1869 has been remarkable from the fact of several of these fine birds—usually considered very rare visitants to our coast—having appeared in Norfolk, and other parts of Great Britain.

About the 7th of May, a young male, which was seen in company with another, was shot in a barley layer on Mr. B. Hume's estate, near the borders of the two parishes of West Somerton and Winterton. On the 25th of May a second was shot at and winged in a Salt Marsh at Thornham near Lynn, and was kept in confinement till the 5th of June, when it died. Again on the 4th of June, another young male was shot at South Pickenham, near Swaffham, which, with four, stated by a correspondent in the "Field" to have been seen at Burnham, of which two were said to have been killed, were probably members of one flock dispersed over that part of the county. The occurrence of so many examples of this bird in one season is the more remarkable, inasmuch as not more than four are known to have been obtained in Norfolk during the last half century. In Sir Thomas Browne's time the Crane is said to have appeared often in hard winters.

MORTALITY AMONGST SWALLOWS AND MARTINS.—The unusually low rate of temperature which prevailed towards the end of May, appears to have caused the death of a very considerable number of Swallows, Martins, and Swifts, throughout the county, the particulars of which have reached me from various quarters. Most of them appear to have been found dead on Saturday, the 29th of May, having been seen for two or three days previously in a very feeble and emaciated state. Hundreds appear to have died about this time throughout the county. Indirectly the extreme and unseasonable cold, was, no doubt, the cause, but on examining the register kept in the rooms of the Literary Institution in this city, I find that between the 24th and 29th of May, the temperature varied at night between 48 and 40 degrees, the lowest being on the Saturday, at which time the chief portion of the

birds had perished. I therefore attribute their death rather to hunger than cold; since the absence of sun deprived them of their usual insect diet, and when thus enfeebled the cold had a far greater effect upon their vital powers. I examined several and in all cases found them only skin and bone, their breast-bones being painfully sharp, and showing plainly the amount of their privations. Swallows and House Martins evidently suffered most, and Sand Martins in a somewhat less degree, being essentially a water-side species. Swifts were also picked up, but these birds, later breeders than the rest, I imagine must have betaken themselves southward to avoid a like fate.

On the 27th of May, a gentleman driving from Bridgham to Harling, found the parapet of the bridge over the Thet lined with Swallows and Martins, which did not attempt to fly away. Some sat in the road and scarcely troubled themselves to stir as he approached. On the morning of the 29th, Mr. Solly, a butcher, in passing over the same bridge, literally drove over a group or two of these poor birds, which he, of course, imagined would rise on his approach, but on descending from his cart found them too feeble to fly, and many of them dead. They sat in clusters of four or five, with their heads inwards and huddled together for warmth. They had collected on the south side of the bridge, protected from the north and east by a small plantation, and of course whilst able to seek their food had frequented the water's side. At West Harling, Mr. J. Ringer had several picked up dead in his paddock on the 29th, and one in a chicken's coop; whilst for a day or two before his men observed them flying into the cattle sheds and stables for shelter whenever a door was left open, tamed to a most pitiable extent, by their want of food. From Yarmouth and Lynn the same accounts were received and at the same time, between the 27th and 29th Mr. Cole, a bird-stuffer in Norwich, had upwards of sixty birds, chiefly Swallows and Martins, with a few Swifts, brought in dead, or dying, by boys, for sale. One man brought in twenty, all picked up in the vicinity of this city. Mr. Crompton ascertained that at Haveringland as many as seventy were picked up dead under the cattle sheds, apparently almost all the birds of the Swallow tribe in that neighbourhood, and similar reports have appeared in our local journals from many other localities.

In Suffolk, the same mortality was noticed, and Mr. T. E.

Wilkinson, of Rickinghall, in a letter to the "Times" of June 4th, says:—"Dozens of Swallows and Martins were found lying dead in this neighbourhood on Sunday last, May 30th, after a severe hoar frost." A similar occurrence is recorded in 1816 by Messrs. Sheppard and Whitear in their "Catalogue of Norfolk and Suffolk Birds." At that time, as late as the 4th and 5th of June, hundreds of these birds were picked up at Christ Church, Ipswich, which had collected in knots, and sat on the grass in parcels of thirty and forty. The same summer many House Martins were found dead in Norfolk, and some were so weak that the cats sprang upon and killed them as they flew near the ground.—*Henry Stevenson.*

NOTE ON THE RECENT VISITATION OF LADY-BIRDS, &c.—Norfolk has shared the advantages derived from the timely visit of immense flights of Lady-birds, and the plague of Aphidès, from which vegetation was suffering so severely, has rapidly disappeared before them. There has been great discussion as to how far we are indebted to immigration for these friendly visitors, and from whence they come; of course opinions differ greatly, but I am inclined to believe we need not revert to that shadowy land, "the Continent," to account for their presence.

In my own garden there have been immense numbers, but the numbers of the larvæ, I observed, was also very great. Their onward movement in search of fresh supplies of food would, I think, account for their congregating on the shore, which has led to the impression that they had just arrived in this country; but their flight, although strong and rapid, is not, I believe, sufficiently sustained to carry them far over the sea, into which they would drop exhausted and perish.

In support of this view I will mention a circumstance which occurred off the Norfolk coast, on the 24th of July last. A yacht belonging to Mr. Cresswell of Lynn, sailing off Hunstanton, passed through a mass of dead Lady-birds, accumulated on the surface of the water, about ten feet broad, and extending for two or three miles, bearing the appearance of a black stripe on the water.

This occurred in the Wash, about nine miles from the Norfolk and thirteen miles from the Lincolnshire shore; the wind was very light in occasional puffs from off the Norfolk shore, and the exact locality the entrance to the channel called the "Bull dogs."

Mr. Cresswell accounts for the presence of this vast mass of dead Lady-birds as follows:—At low water there are uncovered sands, with pools and channels between them, extending from the shore to the navigable channel called the "Bull dogs." He presumes that the mass of dead Lady-birds in the "Bull dogs" were drowned by the rising water covering the crown of the sands on which they had rested, and brought by the current into the vast accumulation the "Wild Duck" passed through.

There is very little doubt these Lady-birds left the Norfolk shore, and alighting on the first uncovered spot they came to, were saved from dropping exhausted into the sea, only to be drowned by the rising flood which gradually covered their island resting place. But had they possessed the strength to renew their flight, and chance directed them either to the Norfolk or Lincolnshire coast, any person witnessing their *return* would probably have been impressed with the belief that they were a fresh arrival from "the Continent."

At the same time and place the "Wild Duck" was surrounded by an immense swarm of what at the time were believed to be Wasps, but which, from the description, I have no doubt were Syrphidæ, of at least two species, one much larger than the other. These were so numerous that they were swept from the sails in thousands, and whilst one man steered, another had to be employed in brushing them off him; as it was they did not escape being bitten, the bite was attended with considerable pain and swelling.

These Syrphidæ had probably accompanied the Lady-birds in their flight; but their superior powers on the wing had saved them for a time from the fate which had overtaken the latter—only for a time however, as they would soon add their numbers to the slain.

The thought suggests itself whether this impulse to leave the shore is not a provision of nature to rid us of what, after having performed its allotted purpose, would prove a serious nuisance if remaining.

N.B. When I wrote the above note I had not observed Mr. Cordeaux's note in the "Zoologist." s.s., p. 1839. On the 24th of July, (the same day as above referred to), about thirteen miles from the Lincolnshire coast, his cutter ran through numerous belts of water "from a few yards to some hundreds in breadth, and extending both to port and starboard as far as the eye could reach;" so full of myriads of green-winged Aphides as to present a "thick pea-soup appearance." The air in and around this city literally swarmed with these insects during the whole of that day, Mr. Cordeaux also mentions the astonishing number of the larvæ of the Lady-bird in the pea-fields—ten or twelve on each plant. "There were many of the perfect insects, but the larvæ outnumbered the parents as fifty to one." —*T. Southwell, Sept., 1869.*





TRANSACTIONS

OF THE

Norfolk & Norwich

NATURALISTS' SOCIETY;

Presented to the Members for

1870-71.

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ADDRESS

Read by the President, the REV. JOSEPH CROMPTON, to the Members of the Norfolk and Norwich Naturalists' Society at their second Annual Meeting, held at the Norfolk and Norwich Museum, March 31st, 1871.

LADIES AND GENTLEMEN—In closing the second year of the existence of the Norwich Naturalists' Society and making way for my successor in the chair, my remarks must be few. Our year's publication of Transactions will show that the past has been neither a useless nor a barren year. Professor Newton's paper on the "Method of Registering Natural History Phenomena," would of itself give a permanent value to our little book, and I believe will cause it to be gladly received by the many kindred Societies with which we are now in correspondence. The great value of the plan consists in the variety and completeness of the information with regard to each species of bird found in the neighbourhood, and the slight amount of labour required to keep up the daily record. Some results derived are highly interesting as, *e.g.* the migratory habits of the Song-Thrush, and there can be no doubt that important results would be obtained by the comparison of Registers kept on Professor Newton's plan in different districts of the county and country.

We have to thank heartily Mr. J. H. Gurney, jun. for his paper giving some of the results of his journey in Spain and Algeria, a district rarely visited by ornithologists, as also to rejoice in finding him following with such ardour and scientific accuracy, the steps of his father, to whom this Museum owes such a large debt for its celebrated collection.

Mr. Kitton has brought before us in his paper "On Growth and Reproduction in the Lower Forms of Vegetable Life," a class of objects for the study of which this region offers peculiar advantages, and of which few men in Europe are more fitted to speak than himself; while Mr. Barrett has contributed a paper I do not hesitate to call one of unusual importance "On Coast Insects found Inland." To this paper I shall again refer before I close, as it seems to me to open views of great interest touching the question of the perpetuation of species; when we think of such extremely frail genera of insects retaining their forms, or even existence, through enormous periods of time, and under circumstances singularly changed. Mr. Stevenson's remarks that same evening on the breeding of certain coast birds on the same spots, corroborated, as they were, by the examples quoted by Mr. Bayfield of the existence of seals in the Caspian Sea and Lake Baikal, in conjunction with the paper, form a good example of those unexpected coincidences which must occur in our studies when accurate observations are made, by which one branch throws light upon another while itself receiving illustration; for I do not suppose that the rationale of the existence of the insects or birds at Brandon would have been so fully made out, had not the little fluttering objects of Mr. Barrett's care been brought to notice.

Mr. Stevenson's paper on the abundant occurrence last year of the Little Gull on the Eastern Coast, with the light he has thrown upon its line of migration, is just one of that class of records combined with scientific discussion of facts, for which this and all Naturalists' Clubs are formed.

It will be remembered that a Sub-committee was formed for the purpose of compiling a Fauna and Flora of the county. The first part is published in this year's Transactions—the Mammalia, by Mr. Southwell, from whose pen we gladly print a former paper "On the Ornithological Archæology of Norfolk." I wish he would have allowed his letter to us from Diss, during his temporary absence, also to have appeared, if only as a specimen of how quiet and simple observation of natural phenomena,

visible from a window or in a garden, may be made as interesting as a chapter of White's History of Selborne. Another part of the compilation of Fauna and Flora is, I understand, far advanced under Mr. Barrett's hand, and, when the whole is completed, it will, we hope, be a valuable addition to the Natural History Literature of the county. We have further to acknowledge, though we do not print, Mr. Crowfoot's paper "On the contending theories of Spontaneous Generation;" also to thank the Rev. J. Bates for laying before us the present state of knowledge respecting "Sun Spots and Solar Eclipses."

Our miscellaneous collection of facts contains a few curiosities, but I regret that we have not kept a fuller record of our conversations, where such facts generally drop out from the experience of members, without the formal preparation of a paper. One point, however, I may be allowed to supply, viz.—that evidence has been given that the Sea Birds Protection Act is already doing good, by the return to their old haunts in increased numbers, of the various species which have for many years frequented them. It is clear that the Act needs only to be enlarged and extended to become a great benefit to the country, as well as a joy to all true students of Nature.

Our Excursions during the past season were not so numerous as we had hoped, for reasons I need not recal. Those which were carried out were much enjoyed, and the plan now proposed for their future arrangement will, I trust, make those of the next and future summers far more effective. All excursions in this neighbourhood labour under the local disadvantage of paucity of railway accommodation, while as with all other Clubs, our changeable climate is a continual drawback, though we are spared the peculiar liability of our Liverpool friends, who, we are told, now and then tempt Neptune on their pleasure and scientific trips, and spend the day in a woful study of anatomy by the aid of sea-sickness.

On one or two points more of general interest will I venture an observation. We meet for the sake of prosecuting Natural History, chiefly, of course, from our own delight in its subjects, but, as I conceive, also for the sake of extending that delight to others, and

with the hope that through us the mental and moral benefits of the study of Natural History may become more widely felt. Time was when objections were made to our studies, and fears were entertained of their tendency. We have passed, or nearly passed, through such fears and objections. No one now will talk of the danger of Geology, and even Darwinian theories are now seen in a better light, whether by supporters or opponents, than was the case not long ago; and therefore surely the desire and the power also, perhaps, has increased of spreading the refining tastes and pleasures of our science to many beyond our circle. The poet and the man of genius are the endowed ones, but we, who listen to and enjoy with understanding the results and outpourings of their genius, are the blessed ones. They exist for us and we for them mutually. So one great privilege and honour of the students of Natural Science will be found, not only in reckoning in their select circle a few successful and gifted observers, but in the fact that through their means the enjoyment and the privilege of an intelligent admiration of Nature is extended to and shared by thousands. May it not be possible, I would suggest, at this moment, when popular education is about to take a great stride, for us and our kindred Societies to devise and urge some means whereby the knowledge and pleasure of Natural History should be laid open both to the young and to the intelligent adults of our cities and villages. The late Bishop Stanley, when a rector, and Professor Henslow in the same position, succeeded to a marvel in their country villages in creating a passion for Natural Science. Some Clubs offer prizes to young people to stimulate them to the study, and with good effect. I look to our Museum and regret to see how little the curiosity which brings numbers here on open days is turned to effective account, and as to the schools already existing, and about to be called into existence, both for juvenile instruction by day, and adult education at night, I can only join with Professor Huxley's regret that popular elementary books for such classes are as yet so incurably bad, and that so little care is taken that the great works of Nature should be properly presented to the quick eye and heart of youth, or the

earnest inquiring mind of the working man. Could some plan to remedy these defects, even in part, be devised in our locality, I for one should be only too glad to support the effort, and believe our Society would be earning the gratitude of our city both for the present and for untold generations to come.

No address to a Naturalist Society, even of so slight a nature as this must necessarily be, can pass by in silence the questions raised by such papers as Mr. Crowfoot's on "Spontaneous Generation," Mr. Barrett's on "Coast Insects found Inland," and still less the remarkable issue of Darwin's "Descent of Man." That such frail species of Noctuæ should have preserved their identity unchanged during the long period which must have elapsed since Brandon was a coast line, and the changes involved in that alteration, though small compared with some of the periods Geologists speak of, opens the eye to the immensity of time that may be required, whether for formation of a new, for a slight variation of existing, or for the extinction of an old species. Personally I do not consider the facts so brought to our knowledge go further than to make us realize the lapse of time and extent of change of conditions required for such development of new or actual extinction of former genera; but it gives great force to an observation made to the Liverpool Society, that though we may regret the loss of rare plants, insects and birds from the few localities where they linger, whether by accident, agricultural changes, or by reckless collectors, yet the fact of such extinction or non-extinction is itself a valuable one for natural science, and an important point to be carefully noted, as much almost as the discovery of a new species. Without entering on the unsettled questions of the origin of species, or discussing the probable truth or error of my old teacher, Dr. Grant's maxim—for to him it is originally due—that the whole creation, from the monad to man, proceeded from a cell on which was impressed the potentiality of development; and without venturing to follow Professor Tyndall into the tremendous vision that all poetry, science, eloquence, and genius, existed potentially in the fire mist of primeval cosmical conditions, of which the sun's photo and chromo spheres may be the relics, I may be allowed to draw atten-

tion to the wonderful variety and extent of learning and observation in Dr. Darwin's last book. He calls it the "Descent" of Man, rather, as has been well said, it is the "Ascent" of Man. If—though I do not say he has succeeded, but if he has proved that man is in body developed from some hairy, sharp-eared arboreal quadruped, some of us will be made to remember our classic reading of Dryads, Hamadryads, Fawns, and other legendary creatures of poets and prehistoric traditions, quite as interesting as heraldic griffins, and dragons, which anticipated geologists, and which we would not willingly give up any more than quite believe; but I would maintain it is an "ascent," in one sense, rather than a "descent," Dr. Darwin exhibits, for when he shows how many creatures, four-footed or biped, far below man in *bodily* formation, yet far surpass not only the lowest, but even many considerably advanced races of men in mental and moral qualities he makes us feel, that whencesoever man has developed in bodily organization, he has risen from a lower condition even compared with the brutes, and certainly proves that whencesoever and howsoever derived, man can never in any stage of development become a complete animal worthy of belonging to the brute company. He must be in body and in mental condition either below the beast or above! We wrong the animals, whose natural history is our study, when we talk of a man being, or making himself a beast or a brute; for the beasts would disown him, and show him to be worse than they, if he is not higher; and we wrong our own higher nature, when we forget or disregard the physical condition in which we are here dwelling.

As the butterfly is ever but a beautiful winged grub, so man carries the limiting conditions of body in his highest flights of power, and in his bodily imperfections is conscious of higher energies and destinies. Whether developed from the protoplasmic matter lining the ocean's bed, and cleaving to its rocks miles deep, or descended from quadruped or biped in bodily organization, I care not; for to use the recent words of Mr. Froude to the students of St. Andrew's University—"It is nothing to me how the Maker of *me* has been pleased to construct the organized substance which I call my body.

It is *mine*, not *me*." The "Nous," the intellectual spirit being an ousia—an essence, we believe to be an imperishable something which has been engendered in us from another source. As Wordsworth says :—

"Our birth is but a sleep and a forgetting ;
The soul that rises in us our life's star,
And cometh from afar ;
Not in entire forgetfulness,
Not in utter nakedness,
But trailing clouds of glory do we come,
From heaven which is our home."

Norfolk & Norwich Naturalists' Society.

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 Athow E. J.

B.

Bailey Rev. J., Stoko Holy Cross
 Barnard C., Jun.
 Barnard Mrs.
 Barrett C. G.
 Bates Rev. J., Kirstead
 Bayfield T. G.
 Bedingfeld E.
 Beoston J. D.
 Beverley M., M.D.
 Bidwell W. H.
 Birkbock W., Thorpe
 Blako R.
 Bond W.
 Boulton W. S.
 Bridgman J. B.
 Brown Rev. J. L.
 Brownfield J.
 Bureham R. P.
 Butcher H. F.
 Buxton S. G., Catton

C.

Caley I. W.
 Capon C. H.

Challis A. W., Eaton
 Clowes C.
 Clubbo W. H., Lowestoft
 Cockburn Miss
 Colman J. J., M.P.
 Cooko M. C., Hon. Member, London
 Cooper R. A.
 Corder O.
 Crompton Rev. J.
 Crompton Mrs.
 Crowfoot W. M., Beeceles
 Cubitt W. Q., Neatishead

D.

Davio Rev. C. R. Ferguson, Yelverton
 Dieken P. H.
 Dowson E. T., Geldeston

E.

Eade P., M.D.
 Evans F.

F.

Farrer J. D.
 Field E.
 Fiteh R., F.G.S.
 Fletcher B. E.
 Fox F.
 Francie W. B.

G.

Gambling J., Buxton
 Geldart H. D.
 Gibson C. M.
 Gilbert S. R.
 Girling Rev. J. C., Great Hautbois
 Glasspole H. G., Ormesby

Goldsmith J. W.
 Gunn Rev. J., F.G.S., Irstead
 Gunn T. E.
 Gurney John, F.Z.S., Sprowston
 Gurney J. H., F.Z.S., Hon. Member
 Gurney J. H., Jun., F.Z.S.

H.

Hancock Thos.
 Harvard S.
 Howes J.
 Hutchison G. S.

K.

Kent A.
 Kett G. S., Brooko
 Kitton F., V.P.

L.

Laurence Rev. J. A., Bergh Apton
 LePelley Rev. J. H.
 Lowe J., M.D., Hon. Member
 Ludlow H. J., Eaton
 Lynn, Natural History Society,
 President of, Hon. Member

M.

Marsham Rev. H. P., Rippon Hall
 Martineau Miss
 Master A.
 Morgan A.M.F.
 Munford Rev. G., East Winch

N.

Newcome E. C., Feltwell, V.P.
 Newton Professor, F.R.S., &c., Hon.
 Member, Cambridge

O.

Orfeur J.

P.

Parker J.
 Pinder T. R.
 Purdy R., Foulsham

R.

Rackham T. J. C., Catton
 Reeve J.
 Reeve Mrs.
 Robinson H. S.

S.

Sawyer J. R.
 Scarles W.
 Slack T.
 Smyth Rev. J. D. H.
 Southwell, C., London
 Southwell T.
 Stannard R.
 Stevenson H., F.L.S., V.P.
 Stracey Miss F., Rackheath
 Sutton Francis
 Sutton Frederick

U.

Upcher Rev. A. W., Wrenningham
 Upcher Rev. A. C. W., Kessingland

V.

Vincent Rev. W., Postwick

W.

Webster N. B.
 White R. W.
 Wilson G.
 Wilson Miss
 Wayman P. S.

The Treasurer in Account with the Norfolk & Norwich Naturalists' Society
for year ending 31st March, 1871.

Dr.		Cr.	
	£	s.	d.
Balance from last year	-	14	11 0
99 Subscribers for 1870—71	-	24	15 0
1 ditto for 1871—72	-	0	5 0
Sale of "Transactions"	-	0	10 0
Mr. Southwell for Manuscript Book	-	0	4 0
<hr/>			
		£40	5 0
		<hr/>	
		12	2 6
Fletcher—Printing "Transactions" for 1869—70	-	-	-
Share of expenses of Museum Soirée	-	-	2 12 0
Subscription to Museum	-	-	2 2 0
Mr. Quinton, jun., Collector	-	-	2 0 0
Stevenson—Printing	-	-	0 19 0
Fletcher—Printing and Stationery	-	-	1 7 6
Secretary, for Postage, &c.	-	-	0 17 0
Balance in hands of Treasurer	-	-	18 5 0
		<hr/>	
		£40	5 0
		<hr/>	

Examined and found correct,

GEORGE WILSON,

AUDITOR.

MARCH 28TH, 1871.

I.
ON THE ORNITHOLOGICAL ARCHÆOLOGY OF
NORFOLK.

BY THOMAS SOUTHWELL.

It is singular how little information we find in the works of old writers, with regard to the Natural History of Norfolk, in the times of which they write, although Lincolnshire and Cambs. are often mentioned, and lists of the birds found there given. This may, perhaps, be accounted for in some measure by the "out of the way" situation of our county; certainly not by any scarcity of the feathered race, which was probably quite as numerously represented here as in either of the two counties named. There is no doubt some species lingered here long after they had ceased to frequent better known districts. Indeed, it would be surprising were such not the case when we consider the geographical position of Norfolk; the coast, projecting into the German Ocean, offering a resting-place for migrants passing to and fro; the broads and fens affording a secure home for the aquatic species; and the woods and uplands of the interior presenting every variety of attraction for those species whose habits required such retreats. So great is its diversity of feature and soil, that as old Fuller truly says, "All England may be carved out of Norfolk, being represented in it, not only as to the kinds but degrees thereof; for here are fens and heaths, light and deep, sand and clay grounds, meadow-lands, pastures and arable, woodlands and woodless."

Drayton, in his "Poly Olbion," says Mr. Lubbock, occupies pages with the enumeration of different species of birds found in Lincolnshire, but dismisses poor Norfolk with a passing intimation that the open country around Brandon is admirably suited for hawking. Camden, too, gives an interesting account of the Lincolnshire fens, but of Norfolk only tells us, when speaking

of Hunstanton, "The catching of hawks, the abundance of fish, with the jet and amber commonly found upon this coast, I purposely pass by, because other places also in these parts afford them in great plenty," (Edition 1695). Gough, however, in his edition of Camden's Brit.,—writing, probably, about 1789,—gives a description of a Lincolnshire Fen, which I will quote, as from the similarity of the country, I have little doubt it would apply equally well to our Broads at the same period :—

"The East Fen is quite in a state of nature, and exhibits a specimen of what the country was before the introduction of draining. It is a vast tract of morass, intermixed with numbers of lakes, from half-a-mile to two or three miles in circuit, communicating with each other by narrow reedy straits * * * * * The multitude of starlings that roost in these reeds in winter break down many by perching on them. A stock of reeds, well harvested and stacked, is worth two or three hundred pounds. The birds which inhabit the different fens are very numerous. Besides the common wild duck,—wild geese, garganies, pochards, shovelers, and teals, breed here. Pewit-gulls, and black terns, abound, and a few of the great terns, or tickets, are seen among them : the great crested grebes, called gaunts, are found on the East Fen ; the lesser crested, the black and dusky, and the little grebe, coots, water-hens, spotted water-hens, water-rails, ruffs, redshanks, lapwings or wypes, red-breasted godwits, and whimbrils, are inhabitants of these fens. The godwits breed near Washenborough, the whimbrils only appear for about a fortnight in May, near Spalding, and then quit the country. Opposite to Foss-dyke Wash, during summer, are vast numbers of Avosettas, called there yelpers, from their cry as they hover over the sportsman's head like lapwings ; knots are taken in nets along the shores, near Foss-dyke in great numbers during winter, but disappear in spring. The short-eared owl visits the neighbourhood of Washenborough with the woodcocks, and probably performs its migrations with those birds, quitting the country at the same time. It does not perch on trees, but conceals itself in old, long grass. Michael Drayton enumerates the following birds inhabiting the fens : 'the duck and mallard, the teale, the goosander, the widgeon, the golden-eye, the smeath, [smew ? ?], the coot, the water-hen, the dabehick, the puffin, the wild swan, the ilke, [elk ? ?], the heron, the crane, the snipe, the

bidcock, [water-rail], redshank, bittern, and wild goose : among such as flying feed, the sea-mere, sea-pie, gull, curlew, cormorant, and osprey," (Camden's *Britannia*, Gough's Edition, 1806, vol. ii, pp. 380, 1). In another place, speaking of Crowland, he tells us : "Their greatest gain is from the fish and wild ducks that they catch, which are so many, that in August they can drive into a single net 3000 ducks ; they call these pools their corn-fields ; for there is no corn grows within five miles."

In addition to occasional scraps of information which come to light, often presenting themselves in strange forms, such for instance as a "bill of fare" at some great feast,—we fortunately possess two very valuable records, one the "*L'Estrange Household Book*," kept during the years 1519 to 1578 ; and the other,—the most valuable of all our local records of the past,—a paper by Sir Thomas Brown, referring to a period about a hundred and fifty years later, and giving an account of the birds found in Norfolk in his time ; his known accuracy and keen-sightedness render this list perfectly trustworthy so far as it goes, and a most welcome legacy to modern ornithologists.

First in point of date comes "the household and privy purse accounts of the *L'Estranges of Hunstanton*," kept during the reigns of Henry the Eighth and his children, from 1519 to 1578, communicated to the Society of Antiquaries by Mr. Daniel Gurney of North Runcton, in 1833. This curious record of the expenditure in the house of one of the "better sort of gentry," when Henry the Eighth filled the throne, is full of all sorts of antiquarian interest, but its great attraction to us consists in the entries containing the names of the wild birds supplied for the use of the household, with the price paid for them, or the rewards given to the servants who brought them as presents from the neighbouring gentry, and often specifying the mode by which they were procured,—as by hawking, the cross-bow, or the gun. In those days the landed gentry depended almost entirely upon home supply for provisioning their establishments, and as most of their out-door servants were boarded in the house, no small quantity was required to supply those patriarchal abodes.* Provision seems to have been

* On festive occasions the quantity of provisions provided was prodigious ; take for example a feast given on the occasion of the "intronazation" of Nevell, Archbishop of York, in Edward IV's reign : Among the goodly provision

more plentiful than money, and we find the rent often paid in kind: thus, in 1519, is an entry, received "A goos, a pygge, a crane, iiij conyes, and a loyn of veile of gyst," or in lieu of rent.

Amongst the birds sent in, the crane is mentioned five times, and, from the price attached to it, I am inclined to think, it was not so much esteemed for the table, (at least at Hunstanton,) as has been generally supposed. The first entry in which a price occurs is as follows:—

Itm pd. for a crane and vj plovs xx^d.

Six plovers, in a subsequent entry, are valued at 1/2, which leaves 6d. for the crane; in another place it is charged 4d., and in a third 6d. The curlew, a common bird now, and, probably, more common still at that time, is valued at precisely the same amounts, 4d., 5d., and 6d. To show that the value attached to the curlew was not excessive, I may mention, that in the Duke of Buckingham's Household Book, (A.D. 1507,) it is put down at 4d. and 5d.; and in Lord North's Household Book, (1577,) at 6/8 per dozen, or rather more than 6½d. each; as neither of these books gives the price of the crane, I am unable to compare it, but the agreement of the three records fixes the price of the curlew at exactly that assigned in the L'Estrange Household Book to the crane. I am unable to compare the price of the crane with that of the heron, as, although the latter is mentioned ten times, in no instance is the price given. In the Duke of Buckingham's book, however, it is charged 8d., and in Lord North's, (so far as I can make out,) 3/4 per dozen, or a little over 3¼d. each. In the present day, I suppose we should not hesitate to choose the curlew for our table in preference to the crane, although, from the latter being to a great extent a vegetable feeder, I see no reason why it should not be excellent eating—certainly as good as a curlew fresh from the sea-shore—but in the time of which we are speaking, it was generally included in the "bill of fare," on festive occasions,

made for the same, were 400 swans, 400 herons, 204 cranes, the same number of bitterns, 1000 "egrittes," 104 oxen, 6 "wylde bulles," 1000 "muttons," 2000 "pygges," 2000 geese, 2000 chickens, 4000 pigeons, 4000 conyes, 1500 hot pasties of venison, 4000 cold ditto, "stagges, buck and roes, 500 and mo," 12 "porposes" and seals, and a profusion of game, fish, and sweets.—*Broderip Zool., Rec.*, p. 159.

where it would make a much handsomer dish than the curlew. I can only infer, from the value attached to these two birds being precisely the same, that the crane was less esteemed for the table than has been generally supposed, or that the curlew was considered more of a delicacy than it now is, or it might be that its wary habits being too much for the cross-bow it was more of a rarity.

The bustard is only twice mentioned; the first time, Christmas, 1527, as having been killed, with eight mallards and one heron, by the cross-bow; the second time, three years after, in the following entry:—

Itm in reward the xxv day of July, [1530,] to Baxter's svnt.
for bringyng of ij young bustards ij^d.

The "reward" does not seem to have been very large, judging from some other entries of the same nature which I add by way of comparison.

The bringers in of 3 "feasands," half a buck, some strawberries, and a "eygnett," each received 4d.; the reward for a fresh salmon was 2d., except on one occasion when the following entry occurs:—

Itm in reward the xxj daye of December, to a felaw that
brought a samon from Lambard, the Miller of Swanton
Mills viij^d.

Possibly the distance may have produced so large a reward in this instance. I am surprised to find the bustard mentioned only twice, as it must have been frequent in Norfolk in those days.

The principal means by which the birds mentioned were obtained was the cross-bow; some idea of the skill with which this rude instrument must have been used may be gained from a list of the birds killed with it, viz.:—wild geese, bittern, mallards, swan, crane, bustard, and heron. Next come the hawks—the goshawk sends in his pheasants; the sparrow hawk, rabbits and partridges; and the brave little hobby, on one occasion fourteen, and on another twelve larks. Water-dogs were formerly trained to take wild-fowl, and to the "spannyells" share fall six mallards and five coots.

Hitherto, both birds and beasts had only the snare, the hawk, and the cross-bow to contend against, but in the first week in November, 1533, a new era is introduced, and a much more terrible engine of destruction comes amongst them—"Itm a watter-

hen kyled wt. the *gun*," and in quick succession a crane, then another, next a mallard, then a widgeon, fall victims to the new foe. From that time, doubtless, the cross-bow would gradually fall into disuse, and the gun, clumsy as it then was, be used in its stead.

On 24th September, 1549, (?) xx^s were sent to "Barnes of London to buy gunpowder wth all." In Lord North's Household Book is the following entry:—

Feb. 22, 1577—A hand gonne and gonne powder	xxxij ^s .
And Sep. 14 of the same year, "Liiij lbs. of gon powder,	
	Lvij ^s vj ^d .
For 14 lb. of matches	iiij ^s ix ^d ."

Guns long remained much too costly articles to be extensively used, and, probably, it is not until comparatively recent times that they have aided largely in the work of extermination.*

The "L'Estrange Household Book" is so interesting a record, that I must ask your pardon if I have dwelt longer than I intended upon it—the difficulty is to know when to stop or what to make choice of.

Sir Thomas Brown's paper refers to the latter part of the seventeenth century, a period about 150 years later than the L'Estrange Household Book. Macauley draws a most vivid picture of the state of England at this time, he says:—"Could the England of 1685, be by some magical process set before our eyes, we should not know one landscape in one hundred, or one building in ten thousand . . . many thousand square miles, which are now rich in corn-land and meadow, intersected by green hedge-

* Besides the birds already named the following also occur:—woodcock, spowe [whimbrel] stint, redshank, knot, teal, peacock, heron, dotterells, sea dotterell, blackbird, sea pye, bittern, popeler [shoveller] pigeon, stock-dove, brant, snipe, and sparrow. I may mention that the porpoise occurs several times; a conger also seems to have been so much esteemed, that part of it was given to "my Lord of Norwich." Fresh salmon often occur, also oysters, (which cost the great Duke of Buckingham 2*d*. per 100,) crabs, "cravose" or crayfish, and a hare killed by the greyhounds. Rats seem to have required a great deal of killing, and "Peter the Rattoner" was frequently rewarded with xx^d for "laying of ye chams [chambers] for ratts," or 4*d*. for "laying of ratten bayn" or poison. We should be very glad to give him 20*d*. for one of the "old English" rats he took so much trouble to destroy.

rows, and dotted with villages and pleasant country seats, would appear as moors overgrown with furze, or fens abandoned to wild ducks . . . many breeds, now extinct or rare, both of quadrupeds and birds, were still common." Foxes swarmed, the white-maned wild-bull was still found "in a few of the southern forests," the badger was common, and the wild-cat and yellow-breasted marten frequent. White-tailed eagles "preyed on the fish along the coast of Norfolk; on all the downs, from the British Channel to Yorkshire, large bustards strayed in troops," and our marshes were still frequented by the crane and the spoonbill. "Some of these races, the progress of cultivation has extirpated, of others, the numbers are so much diminished that men crowd to gaze at specimens as at a Bengal tiger or a polar bear."

The worthy doctor is singularly free from the curious "conceits" so frequent in the writers of his time, as indeed might be expected from the denouncer of "vulgar errors;" and what is most important, records the results of his own observations, scorning the glaring plagiarisms then so common, by which the most absurd stories were again and again repeated. The crane, he tells us, was often met with in hard winters, especially about the open country; but he considers they had been more plentiful, for he adds, "in a bill of fare, when the mayor entertained the Duke of Norfolk, I met with cranes in a dish." Bustards were then common, and "were accounted a dainty dish;" the bittern was also abundant and considered good eating; he "kept [one] in a garden for two years, feeding it with fish, mice, and frogs; in default whereof, making a scrape [*i.e.* laying a train of corn] for sparrows and small birds, the betour made shift to maintain himself upon them." Ravens were so plentiful that he attributes the scarcity of kites about the city to their presence. The black grouse was doubtless then, as now, found near Lynn; for he remarks: "The heathpoult, common in the north, is unknown here, as also the grouse; though I have heard some have been seen about Lynn." Very little is said about the hawks, although they must have been well-represented. The golden eagle he, with his usual caution, disclaimed as a Norfolk bird, although I am happy to say we may now, thanks to the exertions of Mr. Stevenson, add it to our already comprehensive list. The sea eagle, the osprey, found about the fens and numerous broads; the kite, then numerous, and the common buzzard and

marsh harrier, which both bred here in considerable numbers, are all he enumerates—we might safely add the hen harrier, Montagu's harrier (not then recognized as a species,) peregrine falcon, hobby, sparrow-hawk, kestrel, and short-eared owl. Of the fen birds, ruffs abounded in marshland, as also in the marshes between Norwich and Yarmouth; the avocet and cormorant bred here, the latter upon trees, whilst the shovelard or spoonbill had but recently ceased to do so, and the shelducks "herded in coney-burrows about Norrold and other places." Starlings, then as now, made the reed-beds their roosting places, and "settled in innumerable numbers in a small compass." The black-headed gull had its home at Scoulton Mere, and "in such plenty about Horsey, that they sometimes bring them in carts to Norwich, and sell them at small rates, and the country people make use of their eggs in puddings."

The moorhen and coot of course abounded, the stork was sometimes seen, the great crested grebe came in April to breed in the Broad waters, "so making their nest on the water that their eggs are seldom dry while they are set on;" with divers other sort of "dive-fowl." "Teals," he says, "were in scarce any place more abounding. The condition of the country, and the very many decoys, especially between Norwich and the sea, making this place much to abound in wild-fowl." I will not tire you by enumerating all the birds mentioned as inhabiting the marsh districts at that time, but have given the most important, and will conclude by naming a few of those inhabiting the wooded districts:—The green and pied woodpeckers, the nuthatch and wryneck, the latter "marvellously subject to vertigo and sometimes taken in those fits," the hoopoe, the crossbill, which "comes about the beginning of summer," the shrike, the goatsucker, goldfinch, &c., &c., and a roller, killed about Crestwick on 14th May, 1664.

Things are greatly changed in all respects since the time of which we have just been speaking; within the last century (we are told) it is probable that a fourth part of England has been turned from a wild into a garden. Then locomotion was uncertain and attended with great difficulty; the land was unapproachable during several months in the year, and food has been suffered to rot in one place, when only a few miles off the supply fell short of the demand, so great was the difficulty of removing it: (*Macaulay.*)

Now the facilities of transit, both for passengers and merchandise, are so great, that the prices of produce are equalised throughout the kingdom, and any local attraction draws hosts of tourists to the spot. The wild cliffs and headlands which protect our island home from the ravages of the ocean are no longer the remote regions they formerly were, the railway brought them close to the great centres of "civilization," and man, the destroyer, soon found fresh material for the exercise of his avocation. Until the recent passing of the "Sea-birds Protection Bill" put a stop to such practices, excursion trains were run to certain parts of our coast, where during the breeding season multitudes of gulls and auks are known to congregate, conveying large numbers of so-called "sportsmen," who, thoughtless of the cruelty and mischief they were perpetrating, slaughtered them without mercy, leaving their callow young to die of starvation! Every humane man, even though he have not the love for those harmless and beautiful birds, which a study of their habits is certain to inspire, must rejoice that a stop has been put to this wasteful destruction of God's creatures.

One more glance, and that a very brief one, at the feathered population of our county. Another 150 years have passed, and the Rev. Richard Lubbock gives us his "Observations on the Fauna of Norfolk," a book of which it is impossible to speak too highly, and which, fortunately, is well known to most of us. It gives such a picture of the Broad district as almost makes one long for a return of the past; from its careful perusal we arrive (to quote Mr. Stevenson) at the "startling conclusion," that with the exception of the spoonbill and the cormorant, the same species found nesting here in 1671 were still residents up to the close of the present century.

During a period of 150 years, two species only has ceased to breed in Norfolk, but in the fifty years which have since elapsed, no less than six species have entirely deserted us during the breeding season, viz. ;—the peregrine falcon, kite, common buzzard, bustard, avocet, and black-tailed godwit; five other species have virtually ceased to breed here, namely :—the hen and Montagu's harriers, short-eared owl, bittern, and black tern, only a pair or two of which, from time to time and at uncertain intervals, return to their former homes. Several other species are rapidly dis-

appearing, such as the hobby, marsh harrier, Norfolk plover, ruff, sheldrake, great crested grebe, the common and lesser terns, lap-wing, redshank, and ring dotterell.

I have myself talked with men who have taken the eggs of the avocet and black-tailed godwit, and who have seen the bustard at large in its last stronghold. The bittern was so common in Feltwell Fen that a keeper there has shot five in one day, and his father used to have one roasted for dinner every Sunday. I have found the eggs of Montagu's harrier, and know those who remember the time when the hen harrier and short-eared owl bred regularly in Roydon Fen, and who have taken the eggs of the water-rail in what was once Whittlesea Mere.

I will not stop to enter upon the causes which have produced this change, nor upon the present condition of some species which are rapidly disappearing, as I should like to avail myself of another opportunity of doing the subject more justice than I could now, but will merely point out what I shall call the moral of this address—let us all strive to follow the example of the good Dr. Brown, and of the no less worthy Mr. Lubbock, in preserving for our successors a faithful account of what we see and know in our own time, and in collecting all the information possible from every source respecting those species which are passing away from us, or have been lost within the memory of man. I cannot do better than conclude with quoting the words of Professor Newton when speaking of the great bustard:—* “We, the naturalists of the present day, regretting that we know nothing of the extinction of the crane as a British bird two centuries ago—or of the capercally, in Scotland, one hundred years since, are, I think, bound to search out all the legends of the bustard before it is too late, in order to prevent our successors from reproaching us as we do those who lived at the times I speak of—and we shall be the more blameable, for we ought to have profited by their bad example. I need not say that this remark does not apply solely to the bustard's case—but all birds whose existence in this country has already become, or is becoming, a matter of history—and there are, I am sorry to say, many of them—deserve the same attention, and I am sure that however humble our efforts may be to effect this, they will not be thought despicable.”

* In a letter to the writer.

II.

ON A METHOD OF REGISTERING NATURAL HISTORY
OBSERVATIONS.

BY ALFRED NEWTON, M.A., F.R.S., &c.

Read 30th August, 1870.

ANYTHING that helps to facilitate or render less irksome the task of recording observations in any branch of Natural History, must need deserve the best attention of Naturalists. I accordingly trust that the remarks I have now the pleasure of communicating to the Society, may be thought worthy the notice of some of its members, and I do this the more confidently because I have found the method I propose to explain to work well in practice, having had experience of it for a period of more than ten years.

I may premise that I am one of those persons who have never been able to keep a regular journal—in the common acceptation of the term—for any length of time; and, without attempting to defend my failing, in this respect, I may say that I believe I share this defect with very many others. But no one has been more fully aware than myself, of the importance of noting down a continuous series of observations in regard to that part of the animal kingdom to which I have chiefly devoted my attention. Accordingly, I endeavoured to discover a method which would at once secure this desirable result, and yet be free from the objection I have mentioned. It appeared to me that my end would be attained by using a sheet of paper which should be ruled with horizontal lines, so as to occupy each line with the observations of one day, and divided into vertical columns, so as to fill each column with the observations of one species—but in order to save time in entering such observations, as well as to bring them into a convenient space, it would be necessary to keep the record, as far as possible, by means of symbols; and, while naturally using

symbols of the simplest character, to be careful that they should yet be sufficient to express all that one would wish to record. This idea struck me more than twenty years ago—towards the end of the summer of 1849; and I at once began to devise such a set of symbols. A little consideration and a few trials gave me assurance that the plan would not be difficult to practice—and, in I think, the month of September of that year, my brother Edward and I began, by way of experiment, a *temporary* “Register.” This succeeded so well that we set about the preparation of a *permanent* one on a large scale, in the form of a suitable book, in which, being ready by the close of the year, we commenced our work in earnest on New-year’s day, 1850, and either jointly or severally we continued it with a few intervals, when it happened that neither of us was at home, until the end of 1859; then, my brother having taken up his abode abroad, and I (from various causes which I need not particularize) not enjoying the same facilities for observation as formerly, it seemed inexpedient to keep up the practice—for the absence of those facilities would have impaired the value of the observations made at the two periods.

Now before describing our method further, I would remark that the scope of our “Register” was much more extended than, so far as I am aware, any series of observations which had hitherto been carried on by other ornithologists. It was our object to record day by day the appearance not only of every or nearly every species of bird, but, to a greater or less degree, its relative abundance, or scarcity—and, with respect occasionally to some species, the appearance of every individual bird. Though undoubtedly such previous acquaintance as we had with the avifauna of our particular tract of country was advantageous, we did not wish to presume upon that acquaintance more than we could help. We wished to make the birds tell their own story for themselves, so that their appearance or disappearance, their abundance or scarcity, should be shown plainly by the pages of our “Register.” We were not content with merely knowing the date of the first appearance of the Swallow, the Fieldfare and our other well-known migrants, but we wished to know how they appeared—whether singly or in force—whether the males preceded the females, and so forth. Further, we were not content with merely noting the date of the commencement of the song of the Redbreast or the

Chaffinch, but we wished to know whether this act—important as marking the accomplishment of a physiological change in the organization of the performer—was merely an individual peculiarity, or whether it had become general among the species. We hoped further—and in this we were not disappointed—that several hitherto unsuspected facts in the economy of birds might be revealed to us. Thus the series of observations we began to carry on was, as has been said, on a far more extended scale than any which had been previously brought to our knowledge, and, I may add, than any with which I have since become acquainted.

And now for the plan of keeping this “Register” which we pursued. I have already said that the observations were recorded by symbols in such a manner that each day’s work was expressed in one horizontal line, and that the entries respecting each species formed a vertical column. The book we had prepared contains, besides space at the top for headings to the columns, *thirty-one* such ruled lines extending across both pages, so that whenever it is opened it displays at one view the observations for a whole month. The first column to the left marks the days of the month. Next follow ten columns for a rough meteorological register, which had been begun some time before by my brother, and was continued in the hope that it would throw some light on the movements of birds. To this I shall again return, merely mentioning now that nine of these columns are narrow and contain thermometrical and barometrical records, the direction of the wind, and the amount of downfall (if any). These are followed by one, some two-and-a-half-inches wide, left for a brief description of the weather. Then comes the strictly ornithological part—a series of some fifty-five narrow columns, at the head of each of which is written the name of a bird, beginning with the species which, roughly speaking, were supposed to be *Residents*, and then passing to the undoubted *Migrants*—the names of which were included or omitted according to the season. To these succeed three wider columns, wherein are written at full length as occasion requires, the names of birds seen the appearance of which is not sufficiently constant to justify the devotion of a column to them, as well as of downright stragglers; and also such other memoranda as seem worthy of note—the flowering of

certain plants, the appearance of some insects, and so forth. The last column shows the moon's age; this was introduced on the possibility of the movements of migrants and stray birds being thereby influenced. We continued this practice to the last; but I do not think any result followed therefrom, except a record of alternate moonshine and obscurity. The whole book is about eleven inches in height by about fourteen in breadth, or double the latter when open.

This being the general principle or scheme of the "Register," the code or system of symbols used to fill it up requires explanation. That the system is perfect I have not an intention of asserting—indeed if I were to begin a new "Register" it is probable that I should introduce some modifications, but they would, I think, be but slight. Still it would give me pleasure to hear further improvements suggested, only it may perhaps be borne in mind that the code used has worn well for a space of more than ten years, and such might not be the case with a new one, or with one much altered. It is obvious that the chief recommendation of such a code should be its capability of expressing various meanings, especially in combination, and its freedom from complication—in other words its variability united with simplicity. Our idea at the outset was to think nothing wonderful till we had found it to be so. The first symbol we therefore used signifies that the species under whose name it stands appeared (according to our previous knowledge) "*as usual*," this symbol is a plain cross, \times . Starting from this, when the species appeared "*less abundantly than usual*," one half of the cross is omitted, and the symbol is a simple sloping line, /; but on the other hand when the species appeared "*more abundantly than usual*," a horizontal line is added to the cross, \ast ; and if a yet "*still greater abundance*" was noticed, a vertical line was superadded until the symbol had the look of a star of eight points, \ast . When the number of individuals seen admitted of being counted, the Arabic numerals were inserted in the column, 2, 5, 13, and so on; but for clearness' sake—to prevent the possibility of confusion between the numeral 1 and the half-cross (/) already mentioned—the number "*one*" is represented by a dot, \bullet . At times too, when it seems expedient, the well-known symbols ♂ and ♀ , originally astronomical and representing the planets Mars and Venus, are used to

denote the sex of the species observed; and very significant is such an entry as ♀ 3♂ under the heading of "Nightingale" or "Wheatear," recording the arrival (a few days, generally, after the male) of the female of the migrant species, an entry sure to be followed ere long by p , $2p$, $3p$, pp , and finally ppp ; shewing that "a pair," "two pairs," "three pairs," "several pairs," and the "usual number of paired birds," had been seen on that day—for while $2p$ and $3p$ respectively denote two and three pairs, pp signify several pairs and ppp the usual number of pairs. But the mention of this symbol (which, variously combined, makes so great a show in the "Register" for the months of April, May, and June) should, perhaps, have been preceded by the notice of another. I have already referred to our wish of determining the date at which the song of a species commenced. Others, I believe, have kept a record of facts of this kind; but it seemed equally desirable to know how long the song lasted. For these two purposes whenever a bird was heard to sing a dash or short horizontal line — is placed above the symbol (whatever it may be) indicating the mere appearance of the species. If two birds were heard singing, two dashes = are so placed; if three, three dashes ≡; if four, four ≡≡; if five, five—the fifth being marked across the others ≡≡≡, and so on. But, as it was not always convenient to number precisely the musical performers, a single dash with a mark \times across it indicates that several birds of the species were singing, and two dashes with a like cross mark \times signify that the act of singing had become general.

On the same principle as the pairing of birds is shown, so also is their flocking together or associating in family parties—which last seems to be initiatory to the first; the letter f being here used as the letter p was in the former case, with this addition, however, that when the number of birds in the flock was counted, it is expressed by a numeral *after* the letter:—thus $f15$ notifies the observation of a "flock of fifteen;" but $2f$ means "two flocks," ff "several flocks," and fff "many flocks."

These comprehend, I believe, the whole of the symbols we used; and I cannot think they will be deemed too numerous, or too complicated. Should the method appear otherwise on first acquaintance, I believe the difficulty will be speedily found to vanish in practice, though I will admit that the inventor of a system of

notation is perhaps not the best judge of the case with which others may acquire it. However, I know that, by means of this method, the results of a day's observations of many species may be recorded in *less than five minutes*—perhaps in less than half of that time—and that this fact cannot fail to be regarded as a great advantage; for all must have known the discomfort of writing a journal when tired and longing for one's bed, and a tendency, if I may use the word, to “seamp” the work when a “marvellous exposition of sleep” begins to be felt. One more feature of this “Register” need, I think, only be here dwelt upon, and that is, that for the better and more conveniently marking off the different weeks, the Sunday entries are always written in red ink.

Now, as to the use of this “Register.” I have just stated the result of my experience, over more than ten years, as to the comparatively little trouble it took to keep, and accordingly, I have only to shew that advantages sufficient to correspond were derived from it; yet I can safely declare, that they were out of all proportion to the time and labour bestowed by my brother and myself. There is no need for me to urge here the value of obtaining a habit of close, constant and accurate observation; but how much this habit must have been fostered by our ‘Register,’ may be easily imagined, when it is considered that every evening our conscience was not satisfied unless we could give a satisfactory account of each bird seen or heard during the day. It follows that we were thereby compelled never to neglect the feeblest call-note, the whirr of a wing, or the flirt of a tail. I do not mean to say that every bird seen or heard was determined and “booked”—for of course, in spite of every care, the contrary would happen; but I can honestly assert, that the cases in which the species was not identified, were extremely few in number; and great indeed was the benefit of the practice to us, as ensuring continuously our careful attention, as forcing us to take notice of everything that caught our ears or eyes, and as thereby making us become acquainted with innumerable peculiarities of the feathered tribes that are neglected by most men—even by those who are far from being inattentive observers. However good an outdoor ornithologist any man may be, let him adopt the plan here described, and he will become a better one. But the uses of our “Register” have not merely been personal—had such been the case I should not have troubled the

Society with this account of it; but I will give *two* instances of information acquired by its means which was entirely unexpected.

The very first autumn we tried the plan, (that of 1849,) we found, to our great surprise, that the Song-Thrush, after being unusually abundant in September and the beginning of October, about the middle of that month began to grow scarce, until, by the end of November, hardly one was left; and so passed on some ten weeks, when, at the end of January or beginning of February, the species reappeared. Succeeding years confirmed the observation and I was finally enabled to announce (*Ibis*, 1860, pp. 83,85) the unlooked-for fact that with us the Song-Thrush was one of the most regular migrants among birds—a fact which although well known on the continent, had been neglected by almost every English historian of the species. We found the most convenient way of counting the individual Thrushes we saw to be by transferring from one coat pocket to another a common gun-wadding. As shooting-coats have usually many pockets, the process was not difficult; and it was even possible to appropriate a pocket to each of the three species we wished to number. It will of course be understood that the same bird might be counted over again—but for the sake of comparison—one week with another, this did not signify.

Another fact—small, perhaps, but extremely suggestive, which I believe has never been publicly mentioned—we were also enabled by our “Register” to ascertain; and, like the last, it relates to one of the commonest and most familiar of birds. At the setting-in of a sharp frost it is to be noticed—as no doubt it has been noticed before—that the Redbreast suddenly becomes much more abundant in the neighbourhood of houses and gardens. But from repeated observations we found, what I think has not been remarked, that this abundance is caused by the birds, which commonly frequent plantations, hedgerows, and other places at a distance from human habitations, pressing toward the homesteads. The domestic birds remain in their usual haunts; but, if the cold continues, the strangers seem to migrate further—at all events they disappear; yet a few days’ thaw will bring them back. Now, here, I think, we have what we may call the “premonitory symptoms” of a regular migration, and further investigation by the

same means and in the same direction would very possibly clear up that mystery of ornithological mysteries.

I could add some other instances of information being obtained by our "Register," were I not fearful of extending this paper to an unreasonable length. I must just return, as I promised I would, to the meteorological observations which I said we entered side by side with those relating to birds. Since our "Register" was discontinued, neither my brother nor I have ever had time to go through it with the object of digesting such information as it contains, and bringing out the results in a more compressed form; but I am constrained to say that our expectations, that the one set of observations would throw any great light on the other, has not been fulfilled. Beyond the case of the Redbreast just mentioned, and a few similar ones, it would seem that birds, though governed entirely in all their movements by the seasons as they roll, are singularly independent of the ordinary and sudden changes of the weather. Such changes do not appear in any great measure to affect them; and, this being the case, it is not surprising that such changes they do not seem to be able to forecast. However it may be elsewhere, at Elveden (where our "Register" was kept) there was no bird we could regard as a weather-prophet—not even the Green Woodpecker, to whose "warnings" so much credit is popularly given. Nor again, was the advent of casual stragglers ordinarily to be correlated with the occurrence of heavy gales of wind; but, when the distance from the sea-coast of the scene of our observations is considered, this will appear the less singular, for there can be little doubt that tempestuous weather is the chief cause which impels so many strange birds to our shores. Such birds, however, once driven inland may often contrive to maintain themselves for some days, or even weeks, and, occasionally, may wander still further from place to place, so that, when they are at length noticed by naturalists, it is impossible to connect their appearance with any particular storm. Though I am far from saying that meteorological observations should be omitted from any ornithological "Register" that may be kept, I think it is only in the neighbourhood of the sea-coast that the events recorded by such will be found to influence materially the habits of birds.

We daily entered our observations of every species of bird

which occurred in our neighbourhood, excepting only five—the House-Sparrow, Pheasant, Grey and Red-legged Partridges, and Moor-hen. None of these we thought likely to furnish any results that would be useful; for had columns been devoted to them, there would have been little variety in the entries throughout the year.

All these species also, with us at least, lived so much in dependence on man, that they could scarcely be regarded as free agents. But respecting every other species, the record was always kept as minutely as was expedient or possible. Should our "Register" be in existence an hundred or even only fifty years hence, we cannot but think the inspection of it would prove interesting to any naturalist living at or near the place where it was kept, and could other "Registers" on the same or a similar plan be established in other parts of the country, there can hardly be a doubt that some curious and unexpected facts would be revealed from a comparison of the observations.

* * * The accompanying lithographs shew (nearly in *fac-simile*) two pages of the Register above-described as a specimen, and the next two pages are a copy of the Summary of the same, such as was drawn up at the end of the month. It is not thought necessary to insert a copy of the Annual Summary, made at the close of the year.



SUMMARY.

"1851. June 2nd.

"The following is the Summary of the Register of the weather for the past month :—

Thermometer.					Barometer.		Rain Total.
Shade.		Sun.					
Night.		Day.					
Max.	Min.	Max.	Min.	Max.	Max.	Min.	
60	28.7	66	33.5	98.5	30.15	29.39	1.05

"The greatest rise of the Barometer in twenty-four hours took place between 10 P.M. on the 11th and 10 P.M. on the 12th, when the mercury rose from 29.56 to 29.87, being .31 inch; the greatest fall between 10 P.M. on the 24th and the same time on the 25th, when the mercury fell from 29.95 to 29.63, being .32 inch. The prevailing winds were :—on the 1st, SW. ; from the 2nd to 15th, Northerly and Easterly; then Southerly and Westerly until the 18th; and Northerly and Westerly till the end of the month. It rained on 10 days; and the Thermometer was 7 times below the freezing point.

"The following is the result of the Register as regards the appearance of the three resident species of Thrush from the 2nd to the 8th inclusive :—

	No. of days on which each was seen.	Greatest No.	Least No.	Average No.	Total No. seen from 2nd to 8th.
		Seen in a day.			
Misseltoe-Thrush	7	26	5	12.85	90
Song-Thrush ...	7	34	6	19.42	136
Blackbird ...	7	28	8	17.28	121

After the 8th the usual number of each was seen daily.

“The following Table shows the result as regards the Singing of Birds during the past month :—

	Began to sing.	No. of days heard.	No. of days on which the singing was general.		Began to sing.	No. of days heard.	No. of days on which the singing was general.
Misseltoe-Thrush ...	See Apr	21	21	Wren	See Apr	16	7
Song-Thrush ...	do.	30	30	Ring-Dove ...	do.	14	11
Blackbird ...	do.	30	30	Redstart ...	do.	3	0
Hedge-Sparrow ...	do.	17	8	Whcatear ...	do.	15	15
Redbreast ...	do.	30	30	Nightingale ...	do.	25	10
Golden-crested Wren	do.	13	5	Blackcap ...	do.	30	30
Great Titmouse ...	do.	12	2	Garden-Warbler ...	30th.	1	0
Blue Titmouse ...	do.	15	10	Greater Whitethroat	2nd.	3	0
Coal Titmouse ...	do.	8	2	Lesser Whitethroat	See Apr	10	4
Long-tailed Titmouse	do.	4	0	Wood-Wren ...	do.	6	0
Meadow-Pipit ...	do.	11	10	Willow-Wren ...	do.	30	30
Sky-Lark ...	do.	29	29	Chiffchaff ...	do.	28	6
Wood-Lark ...	do.	3	0	Tree-Pipit ...	do.	1	0
Great Bunting ...	do.	8	7	Wryneck ...	do.	16	2
Yellow Bunting ...	do.	29	29	Cuckow ...	do.	20	9
Chaffinch ...	do.	30	30	Swallow ...	do.	11	8
Greenfinch ...	do.	28	28	Martin ...	23rd.	1	0
Goldfinch ...	do.	16	4	Sand-Martin ...	See Apr	9	8
Lesser Redpoll ...	do.	10	4	Nightjar ...	12th.	4	0
Linnet ...	do.	2	0	Turtle-Dove ...	1st.	13	3
Starling ...	do.	30	30	Stone-Curlew ...	See Apr	8	3
Green Woodpecker	do.	5	0	Ringed Plover ...	do.	14	13
Nuthatch ...	do.	8	1	Lapwing ...	do.	16	11

“Arrivals of Birds of Passage during the past month :—

Turtle Dove ...	1st.	Martin ...	3rd.	Spotted Flycatcher	11th.	Nightjar ...	12th.
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“The same birds, whose regularity of appearance was noted for the month of April, have been seen regularly during May, with the exception of the Great, Blue, Coal, and Long-tailed Titmouse, the Green Woodpecker, Nuthatch, and Wren, and the addition of the Meadow-Pipit and Stock-Dove, and, since their arrival, the Spotted Flycatcher and Martin.

“A female Dunlin in summer plumage was shot by myself on the 19th, on Thetford Warren; a female Greater Spotted Woodpecker was caught in a trap baited with an egg, and set for the purpose of catching a Jay, on the 20th: from the appearance of its breast, it had evidently been sitting. On the same day I saw seven Curlews (*Numenius arguata*) flying within gun-shot of the ground, and towards Elden Warren. On the 24th I found a nest of the Garden Warbler with four fresh eggs.—E.N.”

III.

A NATURAL HISTORY TOUR IN SPAIN AND
ALGERIA.*

BY J. H. GURNEY, JUN., F.Z.S.

Read 27th September, 1870.

I LEFT Bayonne for the Spanish frontier on the 25th of December, 1869, little suspecting that five days would elapse before I got to Madrid. As the train passed the pretty watering-place of Biarritz, which lies in a district full of interest, not only as the haunt of the stately Griffon, but as being the very ground which witnessed some of Wellington's greatest battles, (in 1813,) I obtained a fine view of the Bay of Biscay. I was disappointed in seeing no eagles in the Pyrenees, but the spectacle of these grand mountains, wrapped in snow, was surpassingly beautiful. We had the greatest difficulty in proceeding, and at Sumaraga the train came to a standstill, four engines being powerless to move her. After passing twenty-four hours at a village inn the train again started, and, after many stoppages, arrived at Alsasua, where we slept in the wagons.

It was not until the 29th that I reached the capital of Spain. In the game markets, (at Madrid,) which I made a point of visiting, I obtained the pintailed and black-breasted sandgrouse, (*Pterocles alchata*, *P. arenarius*,) crested and calandra larks, (*Galerida cristata*, *Melanocorypha calandra*,) and saw many little bustards, (*Otis tetrax*,) as also the following species:—little owl, (*Athene noctua*,) bean-goose, (*Anser segetum*,) water-rail, (*Rallus aquaticus*,) thickknee, (*Edicnemus crepitans*,) green sandpiper,

* I am indebted to my father for assistance in the identification of species.

(*Totanus ochropus*,) corn bunting, (*Emberiza miliaria*,) partridge, (*Perdix cinerea*.) This last struck me as being very oddly speckled. But by far the most characteristic bird of Madrid is the red-legged partridge, (*Perdix rubra*,) which assumes a brilliancy it never gets in England, and is much more in request than the tasteless sandgrouse. There is a very remarkable melanism of this species in the museum of the Royal Academy. Two specimens very similar to it are in the museum at Paris, labelled as having been "bought in the market in December, 1859." Perhaps it is a race like that variety of the common partridge which has been termed *Perdix montana*. I was not a little surprised to find in the magnificent galleries at Madrid some pictures devoted to ornithology. Many interesting species were delineated, but without much pretension to scientific accuracy. Between the Spanish capital and Cadiz, I saw a grey shrike and many large hawks, at too great a distance for identification. Between Cadiz and Gibraltar, I saw a skua, (*Stercorarius catarrhactes*.) This bold bird was swimming about a gunshot from the vessel.

Gibraltar is rather a good place for birds. It has been surmised that many migratory species take advantage of its proximity to the African coast, and no shooting is ever allowed on the rock. The great tameness of the gulls in the harbour (*Larus ridibundus* and *L. marinus*?) arises solely from their never being molested. From O'Hara's tower I obtained a view of a pair of Bonelli's eagles, (*Aquila bonelli*.) One of these magnificent birds perched on a rock among the brakes, etc., at no very great distance. It exhibited a singular patch of white upon the back. They prey upon the rabbits which abound. That handsome species, the blue thrush, (*Petrocincla cyanea*,) is common on the upper parts of the rock. Its flight and manner reminded me of our ring ouzel, (*Turdus torquatus*.) At a distance it looks rather black than blue, unless the sun happens to shine upon it. It is not easy to get near this shy and solitary bird.

The gay but common Tithy's redstart, (*Ruticilla tithys*,) is much tamer. I saw more males than females. As young males as well have the grey plumage for at least one year, I could not account for it. One of the most attractive birds on the rock is the black wheatear, (*Dromolea leucura*.) It abounds. Here are the winter quarters of some of our common English summer migrants.

Countless willow wrens (*Sylvia trochilus*) enjoy Gibraltar's sunny climate, wintering among the cactus plants ; and I often heard the Sardinian warbler's (*Sylvia melanocophala*) bantering note, and detected the black head of this lively bird clinging to a cactus stem. In fact, these hardy warblers enliven every hedgerow. In several I noticed a brown spot in the region of the chin, which I at first thought was a stain from contact with the red flowers of the cactus, but which Major Irby informs me is really caused by the berries of the pepper tree. With the Sardinian warblers were many blackcaps, to which they bear a general resemblance, as also to the orphean warbler, (*Sylvia orphea*), and I observed the same peculiar spot on some of these. On the rough stony ground I saw the white wagtail, (*Motacilla alba*), and the crested lark, (*Galerida cristata*), and at the rock's summit that rare bird, the Alpine Accentor, (*Accentor alpinus*), and several crag martins, (*Cotyle rupestris*), the most stay-at-home of all the hirundines. The Accentor, when first noticed, was on the outside of the signal station, clinging within a few feet of me to the masonry. It was perfectly tame. I observed Kentish plovers, (*Charadrius cantianus*), in troops of ten or twenty, scampering nimbly along the sandy isthmus which separates the rock from the mainland. A dog disturbed a small covey of Barbary partridges (*Perdix petrosa*) near the old Moorish tower, and I saw with surprise that on the wing this species far more nearly resembles the grey (*Perdix cinera*) than the red leg (*Perdix rufa*.)

On the 23rd I left for Oran in a French packet, which was to touch at Malaga. I noted a dark Lestris-looking bird among some gulls, and many a restless flock of what I supposed to be the Manx shearwater, but I did not on that voyage see any storm petrels, or Cinereous shearwaters, (*Puffinus cinereus*.)

To a person setting foot on a new continent for the first time, everything seems novel, and when at length on the 25th of January, 1870, I disembarked at Oran, capital of that province, my expectations were at a high pitch. I took the first steamer to Algiers, as travelling by land is expensive and slow. Ten days passed rapidly with me at that town. In the morning I generally went out with my gun, and among other birds I was fortunate enough to shoot a hooded shrike, (*Telephonus tschagra*.) In the vegetable and poultry market I saw a concourse of birds. It

was melancholy to see the strings of robins, thrushes, stonechats, titlarks, willow wrens, sparrows, blaekcaps, starlings, wrens, skylarks, and blackbirds.

Before commencing my journey into the Sahara, I visited one or two other towns in *the Tell*,* viz., Blida, Bouffarik, Miliana. The mountains of the Atlas raise their snow-capped summits behind Blida, forming the southern boundary of the valley of the Metidja. Bouffarik is merely a village. Miliana is a fortified town on the slope of Mount Zakkar, overlooking a level plain, watered by the river Chelif.

At these places I got the dipper, (*Cinclus aquaticus*,) mentioned by Loche as very rare, (Exploration se. oiseaux, 1, p. 306,) and many other interesting birds, such as Cettis' warbler, (*Potamodius cettii*, Marm.,) the Spanish sparrow, (*Passer salicaria*,) the dusky ixos, (*Ixos obscurus*,) the lesser spotted woodpecker, (*Picus minor*, *P. ledoucii*, Mallh.,) the meadow bunting, (*Emberiza cia*,) and Moussier's redstart, (*Ruticilla moussieri*.)

After a month spent in this way, I finally started for the interior. I need not describe Boghari, the first halting-place; it is an Arab village, but very poorly represents what I afterwards saw in the Mزاب country.

The first *caravanserai*, properly so called, and the best, is Bougzoul. It is in the Hauts Plateaux. [A *caravanserai* is a white one-storied fortified house, enclosing a large court-yard, with chambers all round for the accommodation of travellers, and stabling for several horses. The *Hauts Plateaux*, or *Steppes*, are interchangeable terms for the northern portion of the Little Desert, (or Algerian Sahara,) which commences where *the Tell* ends, and terminates at Waregla.]

Though but twelve miles distant from the mountains, the water at Bougzoul is nearly unfit for drinking. The guide book correctly states it to be "*rare, saleé, amère, chaude*," four emphatic adjectives which apply only too truly. I suppose it comes by some means from the neighbouring marsh, where the phenomenon of mirage may be seen every day. I believe Dr. Tristram found a profusion of waterfowl at this marsh. When I was there it was nearly dry. The sandgrouse and the desert wheatear had sup-

* Dr. Tristram defines *the Tell* as "the corn-growing country from the coast to the Atlas." (Ibis. 1, p. 277.)

planted the waders, and only the delusive mirage, before mentioned, floated over the hard mud. I saw, however, what I believe to have been three Flamingoes, and was assured by many persons that they are frequently found dead here under the newly-constructed telegraph-wire, as well as *Ganga* (sandgrouse) and other birds.

I found Ain Oussera, which was the second stage, a very sterile lonely place. A muddy stream winds its tardy course before the entrance of the caravanserai, and some attempts had been made to cultivate the stony soil. Elsewhere, far as the eye can reach, nought but a scanty herbage clothes the plain,—a coarse kind of grass, to the height of two or three feet, (different from what grows in the weds,) forming a bleak retreat for the desert wheatear, the dotterel, and the tawny pipit. *Sans* a camel, *sans* a trace of cultivation, the eye finds no relief. As the setting sun sheds a yellow glare over the treeless plain, and the shadows lengthen, one may speculate on the not distant period when troops of lawless Bedouins roamed over the desert. The Barbary states are now at peace, from the palm-shaded oases of Tripoli to the bazaars and gardens of Moorish Tangiers, and the Nomad is brought into contact with the products of European civilization.

I collected specimens of two rare larks here,—*Galerida macroryncha*, (Trist.,) and *Calendrella reboudia*, (Loche,) and of the desert wheatear, (*Saxicola deserti*,) which had not previously been observed so far north, also some calandras and common dotterels, (*Charadrius morinellus*,) and the first hoopoe of the season; but I was not so fortunate as to get the cream-coloured courser's eggs, (*Cursorius gallicus*,) which were here obtained for the first time by Dr. Tristram in 1856, having been previously unknown to science.

Guelt et Stel another caravanserai, is situate in a pass near the seven mamelons, (which were just visible from Ain Oussera.) It is nearly fifty miles from Boghari, and partakes more of mountain than of the desert; here I obtained several birds not in the Sahara catalogue, such as the ring ouzel, ultramarine tit, linnet, serin, goldfinch, Algerian chaffinch and greenfinch, which last was quite common. The water here was totally unfit for drinking.

At Rocher de Sel the soil becomes more sandy; a frost-like whiteness coats the plain; but after passing the salt mountains,

(from which the caravanserai takes its name,) the country assumes a more Tell-like appearance—becoming fertile and woody. These remarkable mountains are well worth a visit; seen at a little distance they present a blue appearance, but it is not difficult to find large pieces of salt of the purest white, and quite fit for the table. They have the additional recommendation of being the home of the kestrel, the raven, the neophron, the kite (*Milvus ater?*) and of other birds; I counted thirteen or fourteen kestrels in the air at one time, and observed that they took their insect prey upon the wing.

After this the road mends; lately built houses, an orchard of almond trees just coming into bloom, and other symptoms of civilization are noted; and, in process of time, our "voiture," if that miserable contrivance for jolting passengers deserves the name, passed the eighth halting-place and arrived at Laghouat.

Laghouat or El Aghouat, according as we prefix the French or Arab article, is the last French out-post; rendered pretty by the number of tall palms, it is in fact the first oasis in the Sahara, while to the north stretch plains as far as Djelpha. Rocky mountain ridges protect it from the wind, which frequently blows the sand in overwhelming clouds. Nearly all the houses are white, flat-roofed, and made of mud bricks. The same materials partition off the Arab gardens. The coach or *courier* arrives about 5.30 p.m., just when the last "red rays" of the setting sun are shedding "a golden pathway" through the forest of stately palms. These matchless trees encompass the town to the number of 20,000, and form a noble belt of verdure, beneath which the vine, the fig, the pomegranate, the olive, the peach, the apricot interlace their foliage, mingling in rank confusion. There is nothing picturesque about the Arabs at Laghouat. The French have improved away the old stock, and the present people are their degenerate descendants. Not so the wild tribes of the true desert, who still cherish a jealous hatred towards that people against whom their hardy fathers swore eternal enmity.

The beautiful desert bullfinch (*Carpodacus githagineus*) was common at Laghouat. Its resorts are gravelly *steppes* and rocky ground destitute of trees. Its trumpet note is one of the marvels of Algeria. The only other birds which I shall notice are the fantail and aquatic warbler, (*Cisticola shuenicola* and *Calamodus*

aquaticus.) which perch upon the reeds, and the *Ammomanes isabellina*. This inconspicuous bird is met with on hill sides and bare stony plains. In its habits it assimilates to the chats, except that it runs more.

Gazelles and jerboas abound, and in the small half-dry marsh there are a good many water tortoises. The ant of the desert digs a curious structure, and perhaps there is not such another place in the world for coleoptera. Beetles of every size and shape swarm. The chameleon is also found; and the deadly viper à corne would be common if not rigorously kept down. Large lizards were often brought to me; one was upwards of three feet long.

On the 9th of April, having engaged Mohammed Belhuri and another Arab, with mules, a camel to carry the luggage, and all the necessaries for an expedition into the Mزاب country, I quitted the little hotel at Laghouat. Mohammed had called me early, and we were "en route" by 10 a.m. We had guns and pistols, for the Mزاب are sons of desert chieftains, and no Frenchman would think of travelling unarmed among them. The embers of the late rebellion still smoulder. As we rode along I shot my first Bifasciated lark (*Certhilauda desertorum*.) Dr. Tristram truly remarks of this species, "that although its uniform of inconspicuous drab renders it most difficult of detection on the ground, the moment it extends its wings, the broad black bar across the snow-white secondaries attracts the eye, and renders it an easy mark:" (*Ibis* i, p. 428.)

By sunset we had reached some clumps of trees—jujubcs, terebinths, olive, &c.; all the large ones had raven's nests, and I may here remark that the ravens of Algeria appear to be much smaller than English ones. They moreover breed in society, but this Professor Newton informs me they always do where they are sufficiently numerous. Our camel took fright at the assemblage of ravens, and utterly deserted us with all the baggage, and we passed the night in our thin burnouses on the ground. Mohammed was well nigh distracted when next morning there was no sign of the missing beast. We got breakfast, of which I stood much in need, at some Arab tents. It consisted of dry dates, "couscous," and sheep's milk. *Couscous* is a kind of broth mixed with half-ground barley, and one of its ingredients is often camels' grease.

The rest of the day was spent in vainly searching for the lost camel; at night we were again the guests of the hospitable Arabs. I noticed several pairs of bushchats (*Saxicola philophthanma*) which, from being unmolested, had learnt to hop among the Arab tents, feeding upon what they found among the small stones, etc.

Next morning, to add to our misfortune, the mules had departed. The intolerable stupidity of the Arabs, in not tying their beasts, is beyond belief. When at length the mules were recovered, the wind was so strong we could hardly mount them. We now began to pass through a vast plain, slightly undulating, interspersed with dayats, each a mile, or half-a-mile apart. I saw many birds which I did not know, but we could not stop after them. I shot one small bird not unlike a white-throat, which, I have no doubt, was a spectacled warbler (*Sylvia conspicillata*.) I have the following note of it in my pocket-book—"Spectacled warbler, with the spectacle faint, and a blush of pink on the breast—eye the colour of a white-throat's." Nearly every terebinth, of any size, carried several nests, and the smaller trees were occupied in like proportion. I may here give Dr. Tristram's definition of a *dayat*. "An unimprovable oasis, in which there is no constant supply of water to be found at any depth." About noon we came to water; it was dirty, but drinkable: a gazelle quitted it as we approached. We often saw these graceful animals, but they were very wild. As we rode along, the desert-horned lark (*Otocorys bilophu*) ran before us like a little plover. Two birds, which I do not doubt were cream-coloured coursers, (*Cursorius isabellinus*,) flew before our mules, and I twice saw, what (unless I am greatly mistaken) was a benighted wryneck, (*Yunx torquilla*,) crouching upon the arid plain.

That night we were forced to sleep out again in the open air. The Arabs kindled a fire, but it was bitterly cold. The wind had got up during the day, and I had only a thin burnous, (for my wraps were on the camel.) At 9 p.m. it rained in torrents—of course our fire was speedily extinguished. The wind now howled over the Sabara. Vivid lightning shot across the sky, accompanied by loud peals of thunder. In vain we shifted to the other side of the bush. Everything was a complete sop. We were in the saddle again before daybreak, but my wet burnous hung on me like a dead weight. Some enormous griffon vultures were

observing us at a little distance, but my hands were so benumbed, that I could hardly hold the bridle, much less load my gun. The heavy rains of the preceding night seemed to have converted the Sahara into mud.

I kept a sharp look-out for ostriches, but had never the good fortune to see one. From what the Arabs said, I gather that many an ancient haunt of this noble species knows it no longer. Its impending extinction typifies the decay of the nomad. Step by step the hunters will drive it backwards. In process of time, its existence will be a matter of tradition—its appearance, its very name, will be forgotten. Like every other brevipennate bird, it must one day succumb to the march of civilization.

At length the wished-for landmark of the Mozabite town of Berryan hove in sight. A carpet was quickly spread for us in an unoccupied house, and the chief, with about thirty other Arabs, squatted in a circle. While Mohammed detailed our adventures, I produced the credentials, which had been furnished by the *Commandant superieur* at Laghouat, and which were afterwards of the greatest possible service to us. It was a two-storied court where we were located, but all the Arab houses are built on the same plan, viz. :—open on the inner side, with a ladder or staircase leading to the roof, which is flat and strong enough to walk upon. They are all full of draughty crevices. In the rafters of the establishment I observed a pair of house buntings (*Fringillaria saharae*.) The Arab masons leave plenty of eligible chinks for them to nest in.

I must attempt some description of Berryan. The town is surrounded by a mud-brick wall, with a good many small towers, some of which I ascended. The fencework upon this wall serves as a favourite perch for the pallid shrike, (*Lanius dealbatus*), which with difficulty keeps its balance, its tail swaying with every gust of wind. The tallest building in the town is the mosque; its tower is in the shape of an obelisk, and about fifty feet high. But what interested me most was the wells. Every garden has one, and they are extremely deep: to draw water, the method is as follows: a long cord passed over the wheel of the well (which is ten feet above the ground) is fastened to two mules or a camel, which, walking down an inclined pathway, haul the waterskin, which is attached to the other end of the rope, to the top of the well, where

it instantly discharges all its contents into a stone tank, and is then let down again. Little trenches convey the water all about the garden: as the sand would soon soak it up, these trenches are of plaster. The water is limpid and tasteless. All day long the Mzab haul it up. They are all teetotalers and never touch wine, which enables them to work hard continually. "The Mzab work always," has become a saying. Men, women, and children, toil in the gardens even in the noontide hours, when no European could venture out of doors without imminent risk of a sunstroke. A different system of irrigation is pursued at Laghouat, where the water lies on the surface.

Having with difficulty obtained some gunpowder, for the French are not allowed to sell it to the Arabs under any pretence, I went out shooting. The Egyptian turtle-dove was so common, that I had only to take my stand in a garden, and load and fire until enough had been killed. Directly a bird falls, the Arabs rush up to it; their object is to cut its throat *before it dies*. Of course they ruin everything for stuffing. I soon found out that they would never cook a dove which did not die by the knife. Every house was tenanted by house buntings (*Fringillaria saharae* Bp.) They nest in the large square court, and I think the eggs must be deposited in March. They are rather like sparrows' eggs, but rounder. The nest is composed of little sticks and twigs, and lined with hair.

On the 14th news came that the Touareg—a lawless tribe of robbers—were assembling in force on the Waragla route. This did not alarm us, but the following day a letter was brought to me (in Arabic) with tidings of a great camel razzia at Zergoun, (which though not in our road, lay to the north of us,) in which 2,000 camels had been carried off, and, it was said, six men killed; but as the Arabs habitually exaggerate, I did not place much reliance on this latter statement. The Spahis* were in hot pursuit, but with little chance of coming up with the fugitives. Trusting that they would not come our way, we on the 16th left Berryan and travelled to Gardaia, which is the chief city of the Mzab confederation. Our route lay through a dreary tract of country—stony, brown, and mountainous—save at rare intervals,

* The Spahis are Arab soldiers in the French pay.

where the dull prospect was perhaps suddenly broken by a patch of green, formed by the rain collecting in a hollow, but these fresh spots were few and far between. And now by narrow defiles our cavalcade drew near this Mozabite capital. I could not help thinking as often as I reined in my mule what awful havoc the long guns of the Arabs would make with an invading army in such a place; and no doubt, for them, many a winding pass here teems with historic interest. The bullet marks on the walls testify that the city itself has figured in many a sanguinary conflict. Standing upon a gentle eminence, crowned by the never-failing mosque, its flat-roofed houses rising tier above tier, above the evergreen palm trees, Gardaia's exotic aspect can never be effaced from my memory.

Her gardens, indeed, stand at some little distance, but they are far more extensive than would at first sight appear, and should be visited in the cool of the morning or in the red blush of sunset. Then the "woods resound" with joyous carols, and the sparkling bee-eater, the painted roller, and the gilded oriole flicker in the foliage like a fairy scene. Nothing can exceed the fertility of this oasis. Vines, surpassing any which I ever saw in size and luxuriance, were bent with many an unripe cluster, trained from palm stem to palm stem, and the figs and apricot trees were loaded with green fruit.

Above them towered 40,000 date palms, affording food and shelter to many species of birds. From bush to bush flitted the subalpine warbler (*Sylvia subalpina*), and the white shrike (*Lanius dealbatus*) sat on every well, or rose to catch the passing locust; while here and there I saw the cunning Numidian malurus (*Crateropus fulvus*) fly with arrowy straightness from the further side of a bush or thicket. Beetles, flies, and *grain* constitute the principal food of this true denizen of the Sahara. When, as I have said, the broken rays of the evening sun were viewed through this mass of foliage the effect was superb.

To return to the city itself; a motley crowd gathered round us as we rode into the market place—brawny men and henna-stained children pressed forward, or mounted on the bench of justice, with greetings and cries of surprise. While we waited at the guest-house for the arrival of a negro with a ponderous iron key, I could not help remarking how many there were in the crowd

who were blind or mutilated. With sunken watery eyes, these poor people presented a sad spectacle.

When we had washed and taken coffee, which is an indispensable ceremony among the Arabs, the chief led the way to the Jews' quarter. We entered the house of a wealthy Hebrew. The Rabbi, as I suppose him to have been, was reading in the doorway; he seemed most anxious to please, and rose on our entry with many genuflections. He showed us his wife, who sat on a door-mat dangling a door-key; she was handsome but rather dirty; the lower half of her nose was painted black. I was much interested in all I saw, particularly the texts upon the wall, and many printed books, some of which I should have liked to purchase. They appeared to be portions of the Old Testament printed in Arabic. We were invited to partake of the thin Jew's bread and some absinth, the most dangerous of all fermented liquors. After that the chief led the way to where his masons were building a house.

I observed that instead of ordinary mud bricks, they were employing stones and plaster, which are probably found to answer better upon a rocky surface where little or no foundation can be obtained.

In conversation with the Arabs the term "tair el h'ohr" was often made use of, meaning the falcon *par excellence*, coupled with the name of Gen. Marguerite, who formerly lived at Laghouat, but is now governor at Algiers, and who is one of the best authorities on the subject of falconry among the Bedouins. It is stated in the "Chasses de l'Algerie" of this author, that the hawks trained for the chase are five:—*El Arem*, *El Mequerness*, *El Bahri*, *El Terchoun*, *El Kreloui*, but Dr. Tristram, an equally good authority, recognises seven sorts:—(*Ibis* i, p. 297,) *El Sakkr*, *L'Abbi*, *El Terakel*, *Tair et h'ohr*, *El Bahri*, *El Bourni*, *El Zebarbach*. My father has kindly compared the evidence, and he is led to conclude that *El Arem* and *El Terakel* are the female *Sakkr* falcon (*Falco sacer*,) and *El Sakkr* the male of that species; *El Mequerness* being the Lanner* (*Falco lanarius*,) and *El Bahri*

* Some naturalists have considered the Lanner falcon as having a good claim to be included in the list of British Birds, on the ground that the figure of Lewin was referable to no other species, (B. B. i, § 17.) All the plates in my copy of that work are so poorly coloured that many are not recognisable.

the Peregrine, which bears the native name of *Byhri* in India. He would coincide with Dr. Tristram in identifying *El Bourni* with the Barbary falcon (*Falco barbarus*), and *Zebarbach* with the hobby (*Falco subbuteo*.) There thus remains three names to be accounted for.

The missing camel turned up on Sunday the 17th, to my great relief. The Spahis had recovered it for me and taken it back to Laghouat. Several of my things had been lost or injured. With the camel came a letter from the captain of the *Bureau Arab* strongly advising my immediate return, on account of the disturbances at Zergoun; but Mohammed overruled this, deeming that it would be better to stay in safe quarters until the country was quiet. Accordingly, we remained with the Mzab for three weeks, during all which time we were fed and lodged gratis, at the different towns we visited, viz :—Mellika, Bou Noura, El Ateuf, Benuisguen. These towns are all in the same oasis, and the dry course of the river winds between them. Bou Noura is a heap of ruins; half the town has been dismantled, and the crumbling, unroofed, long-deserted houses have grown brown like the rocks which surround them. On the other hand El Ateuf and Benuisguen are in better preservation, and contain some shops or magazines where it is possible to buy European products. Benuisguen has long been the rival of Gardaia, and that its inhabitants still aspire to the chieftainship of the oasis was proved by a new wall, which we found then constructing, and which affords one instance of the intestine rivalry which has rendered every stand against the French abortive.

Of course I lost no opportunity of taking observations on the avifauna of such a little-known district. I was particularly struck with the green Egyptian bee-eaters (*Merops superciliosus*.) They seemed to affect the graveyards. Two of the handsomest chats which I met with in the course of my rambles were common at this oasis :—*Dromolea leucopygia*, the white-rumped rockchat, and *Dromolea leucocephala*, the white-headed rockchat, not so

There is less fault to find with the sketch and outline, but even supposing that the picture does represent the true *Falco lanarius* of Schlegel, it will be found on referring to the accompanying letterpress, that there is no reason to suppose that he either drew or coloured from a specimen killed in England.

much in the gardens, as in the "weds" and on the walls. They enter towns freely and perch upon the flat-roofed houses.

We did not start upon our return journey until the last day of the month. One of the chiefs was good enough to accompany me home, and I further availed myself of the convoy of two Spahis, who had been sent with letters from Laghouat.

The first day's journey lay through the stony Chebka Mzab, (where among mountains utterly sterile and bare of herbage, our cavaleade trod foot-sore and weary,) and the only rare bird seen by me was a Houbara bustard; its flight is almost like a bird of prey. It is the falconer's favourite quarry, and defends itself by ejecting a slimy fluid. When the Chebka Mzab was past we again entered upon the sandy prairie which stretches right to Laghouat, and I had further opportunity of examining the dayats which had so much interested me.

It was just the period of migration, (May 2nd,) and wherever there was water, they were teeming with animal life. It was as if all the Spring migrants of Southern Europe had been compressed into fifty acres. Beneath every jujube tree—at every thicket—were massed and congregated all manner of rare birds:—pied flycatchers, (*Muscicapa luctuosa*,) hoopoes, (*Upupa epops*,) doves, (*Columba turtur*,) woodchats, (*Lanius rufus*,)—warblers without end, seeking shelter from the burning midday sun. The neophron (*Neophron percnopterus*) and the raven (*Corvus corax*) perched upon the taller terebinths. Different sorts of sandpipers flew before us mingling with noisy shrikes (*Lanius dealbatus*.) Dozing Little owls (*Athene meridionalis*) dashed out from the deep foliage and hid themselves again.

I suspect that not a few birds are tempted by the water and rich foliage to remain and rear their progeny in these dayats. This is the country to which the Arabs apply the term Sahara. I know it is the Great Desert which is so marked in English maps, but this is the true Sahara—the habitable country which ends where all regular supply of water fails. We rode into Laghouat at 8.30 on Thursday morning; it was nearly four weeks since I had seen a European. I heard on all hands of the camel razzia at Zergoun. I might almost say it had created some uneasiness. I was not sorry to take the first "courrier" and return to Algiers, which I did without further incident, and thence by the usual route to England.

IV.

ON GROWTH
AND REPRODUCTION IN THE LOWER FORMS OF
VEGETABLE LIFE.

By F. KITTON, *Vice-President.*

Read 23rd September, 1870.

“The desire, which tends to know
The works of God, thereby to glorify
The great Workmaster, leads to no excess
That reaches blame, but rather merits praise
The more it seems excess
For wonderful indeed are all His works,
Pleasant to know, and worthiest to be all
Had in remembrance always with delight.”—*Milton.*

THE object of my paper this evening is to give, as briefly as possible, some idea of the nature of the vegetable cell, to trace it from its simplest state to the filamentous and frondose algæ, thence to the higher forms of cryptogamic life, returning again to its existence as a simple cell, in those remarkable forms known as diatoms and desmids.

It would be impossible in the time you would feel disposed to allow me, to enter into a minute description of genera and species. I shall, therefore, as far as time permits, endeavour to describe the remarkable phases connected with the growth and reproduction of the vegetable cell.

To those unacquainted with the minute organisms requiring the aid of the microscope for their study, the remarkable phenomena I am about to describe may appear more like fiction than fact, but those here who, like myself, have used that instrument for many years, will confirm me in the truth of what I am about to state.

The life history of the photophyta does not present any difficulty to the microscopic observer; they occur in such abundance that patience alone is required to trace their growth from the spore to the perfect form.

The question is often asked, what are diatoms? This query, like many others in natural history or science, is more easily asked than satisfactorily answered. The inquirer might be told that they were a species of unicellular algæ, capable of secreting silex: this reply, although perfectly correct, would not probably enlighten the questioner. He might also be told, in simpler language, that they were plants—a reply that would probably be met with by an incredulous “oh!” To those unacquainted with the simpler forms of life, roots, stems, and leaves are always supposed to be as necessary to constitute a plant, as organs for locomotion, sight, and hearing, and certainly a mouth and stomach, would be considered necessary to constitute an animal. In both cases the supposition is incorrect; the simplest forms of plants exist without leaves, stems, or roots, and are, nevertheless, as truly plants as those simple organisms which are destitute of feet, eyes, ears, mouths, or stomachs, are animals.

In order to explain what diatoms are, I will, with your permission, endeavour to describe, in as simple a manner as possible, the plant cell, and if I can succeed in making this understood, I think you will be inclined to admit that diatoms belong to the vegetable kingdom.

The vegetable cell may be looked upon as a membranous vesicle filled with a fluid resembling the sap fluid of larger plants. The walls of the cell consist of two layers; the external portion differs from the internal in composition and structure. The internal cell is called the primordial utricle, or first formed cell; its existence is necessary to the vitality of the cell; it is thin and invisible when in contact with the external wall, but under certain changes which take place in the development of the cell, as by the expulsion of its contents, it becomes apparent. Chemical analysis shews it to be distinctly albuminous, in this respect resembling animal tissues. The simplest form of vegetable cell is well illustrated in the *Torula cerevisiæ*, commonly known as the yeast plant, and is found so abundantly in yeast, that it may be said to consist almost entirely of this minute fungus: it is to the present time a disputed point

as to whether fermentation is produced by the yeast plant, or the yeast plant the result of fermentation. Torula may possibly be only one of the phases assumed by the simple cell. The heterogenists have succeeded in producing the forms known as Torula Leptothrix and Bacteria; but passing by the question as to the truth, or otherwise, of heterogeny, we will avail ourselves of the facts they have accumulated.

The earliest stage of Torula is that of a minute spore, or conidium averaging about the 7000th of an inch in diameter, (the diameter of the human blood disc is a 3200th of an inch, about double the size of torula spores.) It would require 49,000,000 of torula spores to cover a space equal to a square inch; or if one spore is magnified 400 diameters, it would appear about the $\frac{1}{20}$ of an inch in size, an inch enlarged to the same extent would be equal to eleven yards. The spore consists of a membranous sac, containing a soft homogeneous fluid mass, which is protoplasm; this protoplasmic mass is composed of nitrogen, carbon, oxygen, and hydrogen. When a spore comes in contact with any nitrogenous matter, it begins to develope, and in the course of a few hours fermentation has set in, and a series of bead-like filaments may be seen; these have been produced by the adhesion of the new formed cells to the parent cell. This cohesion only continues during fermentation; when that ceases, the cells separate, and cell division stops. Professor Huxley states in a paper read in section D of the British Association last session, that from conidia are developed Torula and Bacteria, and these are further developed into Penicillum or mould.

Many of the algæ may be obtained from every wayside ditch, and if attentively examined, will be found to consist of a congeries of simple cells, sometimes placed side by side, and forming leaf-like expansions, or united in a single series, forming the thread-like filaments, so common in aquaria as to be considered a pest. The rapidity of growth in the algæ is very remarkable; little puddles of water formed by the rain in a few hours are filled with coniferoid growths; a damp surface is frequently all that is necessary to produce an abundant crop. If a small portion, about the size of a pin's head, of *Oscillatoria limosa*, the black slime so common on damp surfaces, be placed in a white saucer with a little water, and exposed to the light, in the course of an hour or two filaments half

an inch or more in length will be found radiating from the original speck.

The mode of growth in the algæ consists in the division and sub-division of the parent cell. When a fragment is placed in a growing slide, and examined from time to time with a microscope, the colouring matter in the cell will be found gradually to separate, and a septum is formed. We have now two perfect cells: this process is repeated with startling rapidity. If the cell belongs to a filamentous species, it divides transversely only; if it belongs to one of the frondlike species, it divides laterally as well as transversely—this is well shewn in the elegant *Phyllactidium pulchellum*.

The algæ, as I before observed, possess neither leaves, flowers, nor seeds; the method of their reproduction is one of the marvels that the microscope has revealed to us. If we examine a few filaments of *Zygnema*, (a very common conferva,) we shall probably detect two filaments, connected by button-like projections, on the edge of the cell, and we may also see that an alteration has taken place in the colouring matter of the two opposing cells; it has assumed a globular form, and passes through the aforesaid projections—the two masses meet and intermingle, and form the sporangium; shortly a movement will be seen, and a number of minute oval bodies, with two or more tails, make their appearance; these are zoospores, and it is truly wonderful to observe their animal like movements, sometimes apparently fixed by the tails, and swaying to and fro like miniature balloons, preparatory to an ascent—now perfectly motionless—now gyrating like a top—now starting off with the rapidity of an express train. After the lapse of a short period the spore becomes languid, and motion ceases, and death has apparently claimed it for its own, but if we watch it attentively, we shall find that it is about to enter a new phase of existence; motive power, indeed, no longer exists, but vitality is still there, and active—it gradually lengthens and expands, the cell is formed, and presently division takes place, and what before appeared to be an animal, has become a true plant.

The green colour of stagnant water is generally occasioned by the presence, in countless myriads, of zoospores. Reproduction by means of zoospores is not peculiar to the algæ; it has been found that liverworts, ferns, and other forms belonging to the class cryptogamia, are produced from them. It may be useful, as shewing

the close relationship existing between the simple cell, and the higher and more complex forms belonging to the cryptogamia, if I give a brief description of the reproduction of a fern. It is hardly necessary for me to allude to the well known brown patches on the back of the fronds; everybody knows that they are spore cases and spores, and that from these spores ferns are produced. They are not, however, the immediate progenitors of the fern; when the spore falls on a suitable surface, it begins to grow. The first indication of vitality is a slight enlargement, and presently one or more root-like processes are thrown out from the internal cell wall; these absorb moisture, and the opposite wall of the cell enlarges, self-division takes place, and a new cell is formed, which again divides, and an organism is produced scarcely to be distinguished from a marchantia—this is termed the prothallium. A further development now takes place—two processes are produced, (the analogues of the reproductive organs in flowers,) termed antheridia and archegonia—one of the cells of the prothallium gradually enlarges, and protrudes; this is at first filled with the green colouring matter; in a short time a small free cell is formed within, containing granules and a mucilaginous material—these are again developed into fresh cells—it at last separates from the prothallium, and becomes an independent organ. The cells now increase in size, and contain, when perfectly developed, a single spiral filament, with six vibratile cilia; these escape from the cell, and rapidly rotate, thus resembling zoospores in their apparent animality—they are technically known as antherozoids: the mother cell is termed the antheridial cell. The second process, called the archegonium, is produced by the swelling out of a portion of the external layer of the prothallium. At the base is an enlarged cell, containing the germ cell; at the top of the archegonium, when fully developed, is a small aperture, through which the antherozoids penetrate, and fecundate the germ contained in the germ cell, which rapidly becomes the primordial cell of the new plant; cells begin to form and subdivide, and gradually differentiate into special organs as roots, stems, and leaves.

I would now call your attention to the resemblance, on the one hand, to the reproduction of the simple vegetable cell, by a ciliated motile spore, and on the other, to the flowering plants; we may compare the prothallium to the flower—the antheridine cell to a

stamen—the antherozoid to a pollen grain—the archegonium to a pollen tube, and the germ to the ovule.

Before quitting the non-silicious algæ, I must allude to the desmidiæ. The members of this family bear a great superficial resemblance to the diatomaceæ, but if carefully studied, important distinctions may be detected. The desmids do not secrete silicic acid; self-division takes place longitudinally in diatoms, transversely in desmids. Diatoms are found in equal abundance in fresh and salt water—desmids in fresh water only.

The desmids resemble diatoms in being unicellular, rarely forming permanent filaments, the non-filamentous forms varying greatly in contour—surface of cells sculptured. The commonest form of desmid belongs to the genus *closterium*, and resembles a cucumber in miniature. Species of this genus, particularly *C-lunula*, may be found in every ditch or bog pool. In this species the interesting phenomena of cyclosis or circulation may be easily observed: at the apices of the frustule are two transparent spaces, within these minute granules will be seen circulating, and if attentively observed, this circulation may be detected over the whole internal surface. A slight progressive movement has been seen in some of the fusiform species, but it is always very languid. The colouring matter (endochrome) in the desmids appears to be the same as the chlorophyll in the larger plants, and on examination by the spectroscope, the absorption band peculiar to the latter material makes its appearance.

The reproductive power lies in the endochrome, and certain changes take place in it previous to the separation of the frustule, and the formation of the sporangium. The external wall of the cell is tenacious, flexible, and not easily ruptured. Mr. Ralfs says that silica is sometimes present, but I have never been able to detect its presence.

Increase by self-division takes place in the desmidiæ; the frustule separates transversely, and a new half is gradually produced. In *Micrasterias* this first appears like a little knob or button; this, in course of a few hours, increases in size, and deep indentations make their appearance, and the new half soon becomes a fac-simile of the older portion.

Reproduction in the desmidiæ takes place in the following manner. When two frustules are in proximity, they mutually

divide, and empty themselves of their contents, which coalesce, and form a globular sporangium ; this, in some genera, is smooth—in others, it is covered with long spinous projections ; this sporangium, according to Hoffmeister, is not a single cell, but is composed of a number of cells, each of which assumes the form of the parent frustule.

The absence of silex, and the delicate nature of the frustule, prevents its preservation in any of the numerous fresh water deposits generally so rich in diatoms. One genus of desmids has, however, been supposed to have a fossil representative, viz., the so-called Xanthidium, so common in flint, (it, however, more resembles the sporangium of the genus Cosmarium than the recent forms of Xanthidium.) These forms were supposed by Ehrenberg to be remains of desmids, but as flints usually contain remains of foraminifera and bryozoa, indicative of marine origin, and the desmidiæ are, as I before remarked, found only in fresh water the theory that they belong to the genus of desmids known as Xanthidium must be given up. The Xanthidium-like bodies in flint, are perhaps the remains of the gemmules of some sponge-like body, originally forming the nucleus of the flint.

We will now proceed to the description of those remarkable forms of plant life called diatomacæ. The non-filamentous species were considered by the early observers to belong to the infusoria—a term still retained by some authors, although the majority of forms described by them are not found in infusions. Ehrenberg has described some of them in his Infusionsthierchen ; he not only overlooked their affinities to the algæ, but even thought he saw organs of locomotion and digestion, and called them polygastrea, or many-stomached, and, I believe, he still persists in their animal nature. He asserts that he has been successful in feeding them with colouring matter, (carmine or indigo,) but as no other observer has succeeded in doing it, I am inclined to believe that he made a scientific use of his imagination, or, in other words, fancied he saw what he wished to see. He says the colouring material was imbibed through what he calls the central umbilicus ; in this he was decidedly mistaken, as there is no aperture through which any substance, fluid or solid, could pass ; the umbilicus, on the contrary, is a thickening of the cell wall. The modern arrangement of the diatomacæ is as follow :—Class, cryptogamia ; sub-class,

algæ; natural order, diatomaceæ; plant, a frustule, consisting of a unilocular, or imperfectly septate cell, invested with a bivalve silicious epidermis; gemmiparous increase by self-division, during which process the cell secretes a more or less silicious connecting membrane; reproduction by conjugation, and formation of sporangia.

Before proceeding further, I may mention that the desmidaceous and diatomaceous cells are termed frustules, and when that term is used, a cell is to be understood. The diatomaceæ are distinguished from all other species of algæ by the power of eliminating from the surrounding water the silex held in solution. This power exists in a high degree in the diatomaceæ; and when we consider that ordinary water contains but an infinitesimal proportion of silica, it must excite our astonishment that a minute protoplasmic mass, enclosed in a cell, should possess the power, not only to eliminate so small a quantity, but also unmixed with other matter held in solution with it, and this not deposited in an amorphous state, but forming elegant designs in or on the surface of the valve. Surely chemical action is not sufficient to account for it, and we are compelled to acknowledge that even as in the highest organisms, so also in the lowest, there exists a mysterious principle called life, defying our utmost efforts to detect or control it; it is as much beyond the power of man to make a diatom, as to make the gigantic oak.

Owing to the indestructible nature of the silicious frustule, diatomaceæ are often found in a fossil state, forming strata of considerable thickness. The city of Richmond, Virginia, is built over a stratum of diatomaceous remains eighteen feet in thickness; this deposit, according to Professor Rogers, belongs to the Miocene period, and so far as I am aware, it is at this period diatoms made their first appearance. Ehrenberg, in his *Mikrogeologie*, figures a form as occurring in the chalk which he calls a diatom, belonging to the genus *Navicula*, but it certainly does not belong to that genus, nor does it possess any diatomaceous characteristics.

The sudden appearance of these organisms in the Miocene period has always struck me as being remarkable, and the majority of the genera and species found in these deposits have never ceased to exist up to the present time; in fact, scarcely a fossil genus but has its representative still living. Some genera of

diatoms, like those larger plants, seem ubiquitous ; they are found existing in equal plenty amid the snows of the Arctic regions, the heat of the Tropics, and the pancake ice of the Arctic and Antarctic seas. Others are limited to very small areas ; for example, we have living in Ormesby Broad a small species, which has never been found in any other locality ; another species occurring in a fossil state in Franzenbad, in Bohemia, has been found in great abundance in a ditch near the Berney Arms, and so far as I am aware, nowhere else. Some genera are only found, in any quantity, on the sand ripples left by the retreating tide ; others form part of the surface flora of mid-ocean, and appear to be the food of the salpæ and noctiluçæ ; and the student availing himself of the stomach contents of those organisms, adds many rare forms to his collection. The salpæ, noctiluçæ, &c., are eaten by fish—these again form the food of the various species of marine birds, the producers of the enormous deposits of guano. These deposits yield up their diatomaceous riches to the careful manipulator, and our little diatom, after undergoing such strange vicissitudes, is at last entombed in Canada balsam, and placed among the choice slides of the microscopist.

The diatomaceous frustule may be compared to an ordinary pill-box, in which the bottom has been replaced by a lid ; the two lids are termed valves—the body of the box the connecting zone or cingulum—the surface of the valve is called the side view—that of the cingulum, the front view. In an early stage of growth the cingulum is very narrow, and, I may here remark, that this is the only part of the frustule that really grows ; the valves never increase, but, on the contrary, decrease in diameter as reproduction proceeds. The cingulum increases in breadth only, and being of later formation, is less firmly siliceous than the valves ; in its earliest stage of formation the frustule is probably little more than a membranous sac, and when this membrane is exposed to the action of water, the secreting process at once commences. The cell membrane upon which the silix is deposited, is perhaps the analogue of the primordial utricle of the ordinary vegetable cell. That such a membrane exists, has been conclusively proved by an experiment instituted by Professor Bailey ; he subjected the frustules of recent diatoms to the action of hydrofluoric acid, and dissolved away the silix, leaving an elastic membrane unattacked

by the acid. The outline of the valve is extremely varied; it may be circular, triangular, quadrangular, pentangular, semicircular, wedge-shaped, fusiform, or wandlike. Some genera secrete a semi-gelatinous thread, and become parasitic upon larger plants. The cell contents consist of a golden brown endochrome, and sometimes two or more oily globules may be observed; cyclosis has been detected in several species when stimulated by light and warmth. That the colouring matter or endochrome is identical with that in the desmids, and the ehlorophyl in the larger plants, is, I think, satisfactorily proved by spectrum analysis, the absorption band occupying the same position as the ehlorophyl band.

The most remarkable phenomenon connected with these organisms is the power of locomotion, and the means by which it is accomplished have not as yet been made out. This movement is most conspicuous in the bacillar or wand-shaped forms, and consists of a series of jerks; it has been used as an argument in favour of their animality, but if attentively studied, it will be found to bear little resemblance to that of even the lowest animal organisms. If its course is impeded by any obstacle, it does not move on one side, but remains motionless for a short time, and eventually goes back by a similar series of jerking motions. This movement has been supposed, by some authors, to be produced by the expulsion of minute eurrents, but unfortunately for this theory, the minutest partieles of matter are not disturbed by the diatom, unless actually touched by it. Professor Smith has timed the rate of progression in several species, and he found that the most rapid moved over $\frac{1}{200}$ of an inch in a second, or rather less than an inch in three minutes, and the slowest $\frac{1}{3400}$ of an inch in one second, or nearly an hour to accomplish one inch.

At the risk of being tedious, I will, with your permission, say a few words on the reproduction of these organisms. You will, perhaps, remember I stated that the cingulum is the only part that grows; within this, two other valves are found, and when this has taken place, the eingulum separates, and we have now two new frustules. Under favourable circumstances, this goes on with great rapidity, but as every new frustule is formed within the old, a gradual decrease of size takes place, and at last self-division ceases, and the species would die out, did not a reproductive process, similar to that in desmidia, place two frustules approximate,

and a union of the contents takes place. A sporangial frustule is produced, much larger than the parent frustule; this sporangial frustule divides, producing other frustules, as before described, and in this manner are accumulated the vast deposits previously mentioned.

The fossil remains of the diatomaceæ are sometimes used in the arts as a polishing powder, under the name of tripoli. Another and more extraordinary use is made of them by savage tribes, viz., mixing them with flour in the time of dearth, and from this circumstance, the German microscopists call these deposits Bergmehl and Essebar Erde. It is scarcely possible that any of the cell contents remain in the organisms found in these deposits, and they must, therefore, be perfectly useless for the purpose of nourishment.

I again allude to the power possessed by vegetable organisms of secreting silex: this, as you are aware, is not confined to the simple types I have been endeavouring to describe, but is possessed by many of the more highly organized forms, as the horsetails, grasses, &c., and, apparently, the leaves of some plants are able to do so even when detached from the stem.

I have lately received from Dr. Lowe, of Lynn, a paper on some silicified forms in mud from the Zambesi; these forms are not peculiar to the Zambesi—they may be found in various fresh water deposits. Ehrenberg has figured, under the name of *Phytolitharia*, several of these forms, supposing them to be distinct organisms. Dr. Lowe has, however, been able to see them in situ, and they prove to be cells belonging to some thick-leaved plant. Now, as no known plant possesses siliceous leaves, the cells must have become so after the leaves had fallen into the water; and, as some of the cells retained the remains of chlorophyl, it is not too much to suppose that they eliminated the silex somewhat as the diatom does, and must have done it rapidly. If these organisms had been only siliceous casts, their formation might have been accounted for by the cell walls acting as a dialyser, and separating the silica in a colloid state from the surrounding water, but this is not the fact—the cell walls are silicified, the interior remaining hollow as before.

This power of appropriating silex from the surrounding waters is possessed in a far greater degree by plants than animals, and

these of the lowest type, viz., the polycystina and sponges—the former investing the sarcodous mass with a silicious carapace, of marvellous beauty—the latter strengthening the horny matter with spicules of various shapes, or, as in *Euplectella*, weaving one of the hardest and most obdurate of substances into a framework of surpassing elegance. The elimination of silex is not confined to the protophyta; the grasses, canes, &c., do so, and deposit it in various forms on the exterior of the stems, or in the form of scales on the leaves, and even the petals of the flowers. The *Deutzia scabra* is a familiar instance of this. Another substance, even more common than silica, viz., lime, does not, as far as I am aware, form any part of the structure of plants, from the lowest to the highest, excepting a genus of marine algæ, the *Corallina*—and species of the genus *Chara*, are sometimes found covered with a calcareous crust, but this is not essential to their well-being. Raphides and sphæraphides may also be cited as evidences of lime being taken up by plants, but these again appear to be of no importance to the welfare of the plant; but if we turn to the animal kingdom, lime plays an all-important part in its economy—lime forms the humble home of the foraminifera, and it constitutes the principal portion of the mammal in its highest state of development.

Ladies and gentlemen, I have endeavoured, as briefly as possible, to convey to you some idea of what a diatom is, and its claims to a place in the vegetable kingdom, and in order to render this claim intelligible, I have thought it desirable to give a short account of the vegetable cell in its various forms; and I think you will see that a desmid and a diatom are, if I may use the expression, merely arrested states of vegetable life, that is to say, the cells exist apart, and do not differentiate into various special organs, consequently the life of one cell does not necessarily depend on that of its neighbour. This is a peculiar characteristic of the lower cryptogamia, for although many of the lower forms of flowering plants continue to live if cut into very small pieces, *Anacharis alsinastrum*, for example, the cells of which it is composed never exist apart; but when we ascend higher in the scale of vegetable life, the cell is still less capable of self-existence, and special conditions have to be observed, to enable detached portions to vegetate: it will not do to cut indiscriminately—a piece of

bark will not grow, neither will the stem, if deprived of its bark.

The study of the lowest forms of life still occupies the minds and time of our greatest biologists, both at home and abroad; and I would recommend all those who possess a microscope to study the life history of one of the numberless forms of animal or vegetable that may be found in every drop of stagnant water. There is at present too much desire among those who have an instrument to collect objects that are pretty, thus making natural history subservient to the microscope, instead of using it as an adjunct to the study of natural history; and I cannot help thinking that if used for the latter purpose, the naturalist who has devoted his leisure to the study of the larger forms of life, will not despise those who make use of the instrument for the study of minute organisms. They may appear trivial, and not worthy of attention, but as it has been wisely said, "in every object there is inexhaustible meaning: the eye sees in it what the eye brings the means of seeing." To Newton, and Newton's dog Diamond, what a different pair of universes, while the painting on the optical retina was most likely the same! And let us, as students of nature, bear in mind Galen's aphorism, "Naturam maximé admiraberis si omnia ejus opera perlustraris."

V.

ON CERTAIN COAST INSECTS FOUND EXISTING INLAND AT BRANDON, SUFFOLK.

BY CHAS. G. BARRETT.

Read 29th November, 1870.

IT is a fact well known to Entomologists, and probably to Naturalists generally, that the sandhills which partially line our coasts form the exclusive habitat of many species of insects of various orders, and that these species are seldom, if ever, known to wander from the sands, even to as short a distance as a mile, or it would almost be safe to say a hundred yards.

Of such, among the Lepidoptera, are several species of Noctuæ

belonging to the Genera *Agrotis*, *Leucania*, *Mamestra*, &c., two or three *Geometra*, a few *Crambidæ* and *Phyeidæ*, and a number of *Tineina*, especially of the large genus *Gelechia*. These insects shelter themselves during the day at the roots of the rough grasses and stunted plants that grow on the sands, and especially under the overhanging edges of the hills, whence the sand has fallen away, leaving the roots and herbage hanging down; but always carefully avoiding exposure to the wind. So much is this the case that an experienced Entomologist upon arriving at a range of sand-hills, knows at a glance by the direction of the wind where to look for the insects.

The larger and stronger species fly at night, the smaller ones in the afternoon and evening, when the weather is moderately warm and still, but many of them will not stir on the wing except on the calmest evenings, the species of the genus *Gelechia* in particular being so excessively sensitive to wind, that in order to dislodge them from their hiding places among the grass, furze, or moss, it is only necessary to blow sharply, with the breath, among it, when the little creatures come hurrying out, and dart away into some sheltered spot at once, not hesitating, occasionally, to settle on the clothes of their tormentor, but always carefully choosing the sheltered side.

Now it happened that early last June I arranged to meet one of our Vice-Presidents, Mr. De Grey, at Brandon, in Suffolk, for a day's collecting. Our sport was capital—indeed I have had the pleasure of exhibiting here on a former occasion, some of the rarities which I then captured for the first time—but among the insects we took were five species, (which I beg now to lay before you) namely, *Mamestra albicolon*, *Anerastia lotella*, *Gelechia desertella*, *Gelechia marmorea*, and *Gelechia distinctella*, four of which are considered to be most exclusively coast-sandhill insects, and the fifth, *Gelechia distinctella*, is scarcely ever met with in any different locality.

I have no doubt that some of the members present, especially those who are also Geologists, are well acquainted with the peculiar soil of Brandon, and the adjoining country for some distance. But for the information of those who are not, it is necessary that I should say, that it is a loose light sand, precisely such as is found on the North Denes at Yarmouth at the present time.

About its origin, I have consulted one of the best practical Geologists of this county, a gentleman well known to you, and am informed by him that there is no doubt that this tract of country was actually a range of *coast* sands, at a comparatively recent point of the Post Glacial period, while the great valley of the fens was still submerged. This range of sands, however, does not appear to extend anywhere near to the present coast. The nearest sea is the Wash, upwards of twenty miles away, and the Eastern coast with its belt of sandhills is forty miles distant, the intermediate country being, in both cases, of a totally different character.

Although the Post Glacial epoch is, I believe, Geologically speaking, a very recent one, the actual length of time since passed is so great, that I presume few Geologists would venture to compute it, even in thousands of years. The occurrence, therefore, at the present time of these coast insects, on this ancient sea-shore, is a circumstance of considerable interest, particularly as they appear to be by no means scarce there—indeed *Gelechia desertella* swarms in hundreds in the rough fields and among the stunted furze bushes—and the question naturally arises, by what means they became settled in so congenial a spot. The immediate answer to be expected is “By migration,” and abundant theories instantly crop up of chance specimens carried across country the whole distance by storms of wind. I am, however, from knowledge of their habits utterly unable to accept this solution, especially in the case of the weakly constructed *Anerastia lotella* and the little *Gelechia*. I hold it to be physically impossible for their delicate frames to survive such treatment.

The “blown across” theory may possibly hold good sometimes in the case of strong winged, day flying insects, such as the butterflies, which, provided the sun be shining, are ready to brave a considerable amount of wind, but with insects whose special aim is to avoid it, and whose instinct in foreseeing changes of weather is so fine as never to seem at fault, such a solution is utterly untenable. Moreover, the “blown across” theory is only applicable to the comparatively level surface of the sea where the wind has free course. In crossing a country covered with scattered trees and with occasional hills and other inequalities of surface, the disturbing currents caused by them would soon and certainly precipitate such matters to the ground, or enable them to reach it.

To suppose that ordinary migration or spread of species would explain the difficulty is out of the question, since I have already shown that it is contrary to the habits of the species to travel on to uncongenial soils, where, even if pressed to do so by excess of numbers, they would be unable to exist.

Nobody will of course venture to suppose that there has been a special creation for this small tract of country, and we are therefore, as I think, driven to the conclusion that the species in question have occupied this suitable ground, from the time of the close of the Post Glacial period *at least*, and that they have remained unchanged in form, and even in colour, all through the changing conditions of life occurring during the upheaval of the fen valley, and the consequent alteration of our coast line, and particularly those caused by the change from the saline influences of the neighbouring sea, to those of a warm inland district.

One slight change of habit is apparent, due doubtless to the increased temperature. All these species were out on June 4th, *desertella* in swarms; and a week later *lotella* was common and *albicolon* getting worn, while at the same time *albicolon* and *desertella* were just beginning to appear at Yarmouth, and the other species were not to be found there till a fortnight later, *July* being their time of appearance on the coast.

It would now be very interesting to ascertain whether *Eubolia lineolata*, *Leucania littoralis*, *Agrotis velligera*, *cursoria* or *ripæ*, all of them inhabiting our present coast sands, were also still to be found in what may probably have been their ancient haunts.

A small scrap of additional evidence has come to hand since this paper was written. In a list of Lepidoptera, contributed by Mr. De Grey to our county list, is the name of *Gelechia pictella*, a more delicate species than either of those I have mentioned, and one which almost exclusively frequents coast sandhills, found also at Brandon.

December 20th.

Since the paper read at the last meeting was written, I have received some valuable confirmatory evidence. The Rev. H. S. Marriott, of Wickham Market, and Rev. H. Williams, of Croxton, inform me that they find *Eubolia lineolata* commonly on the grassy heaths, and *Agrotis velligera* flying in Lucerne fields round Thet-

ford, besides meeting with the larger species which I mentioned ; and Mr. De Grey tells me that he has taken *Agrotis cinerea* and *Gelechia vilella*, (both of them much rarer sandhill insects,) at Brandon, and *Gelechia marmorea* as far away as Tottington, on the Merton estate, to which place the drift sand extends.

These further observations enable me to bring forward another very interesting point, which I felt hardly justified in deducing from the data in my possession a month ago. It is this—most of these species belong to large genera of closely allied and abundant species, (*Agrotis*, *Mamestra*, *Gelechia*,) genera such as have been pointed out as most likely to produce new species by natural selection—dominant groups, in fact. These species, however, in spite of their isolation and alteration of condition, are as true and as clearly defined as those of our present coast.

VI.

ON THE ABUNDANCE OF LITTLE GULLS ON THE NORFOLK COAST IN THE WINTER OF 1869—70.

BY H. STEVENSON, F.L.S.

Read 20th December, 1870.

It is rarely a year passes that is not at one period or other remarkable for some ornithological occurrence of special interest—either the advent of a new or an extraordinary excess in the number of some other species, commonly looked upon as a rare or uncertain visitant. Thus, of late years, we have had an invasion of sand-grouse, a plethora of waxwings, shorelarks, and storm petrels ; during the present autumn a surfeit of quails, and in the winter of 1869—70, such an influx of little gulls as had probably never been known up to that date. Judging from former records of specimens obtained, this small and very elegant species has been observed occasionally on our coast, the stragglers procured from time to time being, almost invariably, young birds, but

supposing even that a few—mingling with the large flocks of common and black-headed gulls, which in autumn and winter frequent our shoals, sandbars, and tidal estuaries—may have annually visited us, still their appearance in February, 1870, both here and in more northern counties in such extraordinary numbers, is a fact worthy of special record.

In the *Zoologist* for March, 1870, (p. 2056), I stated that a little gull, in immature plumage, had been sent me from Salthouse on the 23rd of October, 1869, and that another, in similar plumage had been also killed at Blakeney on the 30th of the same month; both of these, as is commonly the case, were solitary specimens, and no more appear to have been remarked until about the end of December or beginning of January, when another immature bird was shot somewhat inland at Gooderstone, near Fakenham, and preserved by Mr. Ellis, a birdstuffer, at Swaffham. The weather up to that time had been mild and open, but from the middle to the end of January we experienced severe frost and snow. With the 1st of February, however, came a few warm sunny days like a foretaste of spring, and then again, on the 6th, the wind veered to the N.E. with heavy snow storms on the 8th and 9th, followed on the night of the 12th and throughout the following day by a biting wind frost, more severe during the short time it lasted than had been experienced for many years.* On the 13th the wind from the N.N.E. blew a heavy gale, drifting the frozen snow like sand, in places sweeping it clean off the roads, and in others heaping it up above the banks and hedges.

It was just at this time, storm-driven and suffering from the severity of the weather, that the main body of little gulls appeared on our coast, and of the numbers which fell victims to the gunners between Lynn and Yarmouth, the larger portion were procured between the 12th and 14th, and others during a period extending from the 10th to the 28th.

On the 11th, as stated by Dr. Lowe, in the *Field* of February 26th, a flock of at least a dozen were seen in Lynn Harbour, sheltering from the gale outside, of which several are, no doubt, included in the following list, supplied me by Mr. Wilson, bird

* Mr. Cordeaux, in the "*Zoologist*" for 1870, remarks "the 12th, 13th, and 14th of February were the roughest days I ever recollect on our Lincolnshire marshes."

preserver, of that town:—February 11th, two shot in Lynn Harbour; 12th, one on the Estuary Bank; 14th, two ditto; and one in Lynn Harbour; 15th, one on the Estuary Bank. All these were in full adult plumage, five males and two females. About the same date Mr. Baker, a bird preserver at Cambridge, received three adult specimens from Hunstanton, where a gunner is said to have shot thirteen in one day, but considering them too small to make plumes for ladies' hats! threw them all away. Mr. Micklefield, of St. John's College, Cambridge, also killed three at Hunstanton the same week, a male and female adult and an immature male, and some eighteen or twenty were seen. Mr. Baker, although too late to procure any himself, believes that he saw two or three flying inland when travelling by rail to Hunstanton on the 19th.

On the 12th I received an adult male and a male in immature plumage, from Salthouse, both shot on the previous day, and another adult male was killed at the same place on the 10th. On the 12th, also, Mr. J. J. Winter, of Norwich, shot an adult male on Cromer Beach, the wind, as he tells me, blowing a heavy gale at the time, and many large gulls were driven in by the storm, but no more little gulls appeared amongst them. On the 14th, Mr. H. Upcher received an adult male from Cley, and on the 15th, an immature female from Salthouse; and the same day an adult female from Sherringham Beach. A pair now in my collection, male and female, adult, were also killed at Hasborough on the 15th.

At Yarmouth the large number procured were nearly all killed between the 12th and 14th, but the market being somewhat glutted, they were still offered for sale up to the 19th and 20th. As far as I could ascertain at the time, at least twenty specimens were shot on the beach during the height of the gale, of which six couples, all adult birds came under my notice, and some were, I believe, sent up to Leadenhall Market, where, from first to last, about thirty specimens were received, chiefly from the Eastern Counties. A pair of adult birds, killed at Hickling, near Yarmouth, on the 17th, were the only examples, to my knowledge, which in that locality were not shot on the beach. Amongst the birds sent to our Norwich bird stuffers, three were from different localities in Suffolk—Wendling, Beccles, and Lowestoft—but all these were amongst the latest birds killed; indeed, the last that I

saw in the flesh was shot on Gunton Beach, near Lowestoft, by Mr. Fowler's gamekeeper, on the 18th, when others were seen, possibly passing further south after the storm had abated.

Altogether, as far as one can judge from fairly reliable "heresy" evidence, over sixty specimens were killed in this county; forty-two I can vouch for, having handled most of them myself; and judging from the various records in the *Field* and *Zoologist*, Bridlington Bay, on the Yorkshire coast, appears to have been the only other locality in which these gulls appeared in any numbers,* and there also the same wholesale slaughter awaited them as on our own inhospitable coast. Mr. Cordeaux, (*Zoologist*, p. 2081,) on the authority of Mr. Richardson, of Beverley, states that twenty-nine little gulls, nineteen adult and ten immature birds, were shot near Bridlington early in February, and these, from Mr. Boynton's statement in the *Field* of February the 26th, seem to have appeared simultaneously with the large numbers that visited Norfolk, and were driven in by the same severe easterly gales.

The few specimens of this gull which in previous years have been procured in Norfolk, have appeared both in autumn and winter, from August to the end of January, but extraordinary as was the influx on this occasion, it was attributable, I think, far more to accidental circumstances than to any unusual abundance of the species during the previous nesting season. With gulls, as with most wild fowl, the young birds are more accessible, and as a rule, are procurable earlier in the season than the old ones, which are "driven in" only by stormy or frosty weather. Thus the three immature birds shot in December and January, represented the ordinary stragglers from the main body of migrants, which, probably in most seasons, desport themselves off our northern coasts, and regulating their movements by the mildness or severity of the weather, pass on, almost unnoticed, to more southern quarters. The eggs of this species have been lately received by

* The few notes of the occurrence of stragglers in other parts of England are only such as are ordinarily met with during the autumn and winter months. An unusual number of these gulls were shot at Bridlington, Filey, and Flamborough, on the Yorkshire coast, in October, 1868, as recorded by Mr. J. H. Gurney, jun., in the "*Zoologist*" for that year, but at that time I believe only one specimen was procured in Norfolk.

my friend, Mr. Dresser, from Lake Ladoga, where they nest in great numbers; and, as at present it is not known to breed anywhere further to the north or west, we may presume that those which, in autumn and winter appear on the coast of Great Britain, form part of that colony, and that migrating in a westerly rather than a southerly direction, they have passed from the Baltic into the North Sea. In this instance, however, the main body of them appear to have been suddenly driven by the irresistible force of the gale upon our shores and estuaries, and thus afforded a chance to our local collectors, which, except under similar circumstances, may not occur again.

The great predominance of adult birds, amongst the specimens procured, still further marks the accidental character of their visitation, the proportion being—amongst such as I can speak of with certainty—six immature to twenty-nine fully adult; but it is difficult to account for the great predominance of males, as proved by dissection, the females presenting about the same proportion in numbers to the males, as the young to the old. In plumage the young exhibited the usual variations, from the mottled plumage of the bird of the year, with its brown head and collar, the grey of the back sprinkled with brown, and the dark primaries but sparingly relieved with white, to that more mature and interesting stage, when the head and back have assumed the grey tints of the adult plumage, and the grey and white are gradually extending to the secondaries and primaries. In this stage, however, each wing is barred with brown as in the young kittiwake, and the tail is still broadly tipped with the same colour. The old birds, one and all, presented the exquisite contrast of grey and white, that marks the winter dress of this species in both sexes, the crown and back part of the head smoke grey with a dark spot below each ear covert; the sides of the neck and breast, back, and upper surface of the wings, pure French grey, relieved by a white margin to the tips of the primary and secondary quills. The under surface of the wings dark slate grey, showing the same white edging, and the tail and under parts, generally, pure white, with the breast and vent in most specimens, when freshly killed, suffused with a lovely tint of rose colour. But one bird out of all I examined in this grey plumage, exhibited the slightest variation from these general features of the adult dress; but in this instance a female, in my

own collection, killed at Hasborough, the plumage is particularly interesting as showing the last trace of immaturity in the primary quills. Each of these feathers, though broadly tipped with white, has a patch of black of more or less extent forming with the wing closed, three alternate bands of black and white towards the extremity of the feathers, but in this transition state, the gradual encroachment of the pale grey and absorption, as it were, of the dark patches, by an actual change of colour in the feathers, and not by moulting is very remarkable ; a process, moreover, which is clearly perceptible in far less mature specimens. The tail feathers in this bird are pure white, but the feet and legs were somewhat less vivid in colour than in other adult specimens.

In the adult bird the beak is dark brown, becoming reddish brown on the lower mandible ; inside of the mouth rich salmon colour ; feet and legs vermilion red, inclining to orange in some cases. In the young bird the beak is almost black, throughout ; the inside of the mouth lighter in tint than in the adult ; legs and feet livid pink. The irides in both old and young dark brown, but no colouring round the eye-lid at this season of the year.

The stomachs of some of those dissected contained remains of small fish, shrimps, and sand worms, with sand and gritty substances. In the stomach of one were five sticklebacks, some of which could be identified as the ten-spined species ; in another was a small fragment of chalk with seaweed attached, and something very like a minute portion of mutton fat. Examples in the flesh, weighed by Mr. T. E. Gunn, varied from three ounces in immature birds to four and a half ounces in adults.

VII.

FAUNA OF NORFOLK.

PART I. MAMMALIA AND REPTILIA.

BY THOMAS SOUTHWELL.

Read February 28th, 1871.

WHILST it is the duty of a Natural History Society to endeavour to popularize the study of nature, and by every means to awaken an intelligent interest in the minds of those who have disregarded the wonders which surround them, it is not less incumbent upon such a society, by carefully compiling lists of the Fauna and Flora of their immediate district, to assist in furnishing materials for works of greater pretensions and more comprehensive scope. It is impossible for the author of a history of any branch of natural science to make himself minutely acquainted with the productions of every locality, or to trace out and eliminate species of doubtful authority, but by availing himself of the observations of many naturalists, condensed in the form of local lists, materials are placed at the disposal of the master builder which will enable him to construct a faithful history of the habits, frequency, and geographical distribution of the subjects of which he treats. We think, therefore, no apology is needed from the Norfolk and Norwich Naturalists' Society for endeavouring to compile faithful and accurate lists of the natural productions of the County, accompanied by such remarks as may be considered desirable, on the rarer species under consideration.

As might have been expected from a County which has produced so many naturalists of note, many lists have appeared from time to time, amongst which, those of Sir Thomas Browne, Sheppard and Whitear, C. and J. Paget, Gurney and Fisher, Mumford, and Stevenson, are of great value, particularly Mr. Stevenson's most

exhaustive history of the "Birds of Norfolk;" but in only one of these (C. & J. Paget's "Natural History of Yarmouth and its Neighbourhood") has the plan included a general list of the several departments into which the animal and vegetable kingdoms are divided; and this exception applies but to a limited district—added to which the constant changes which are taking place in the physical features of the County involve corresponding changes in its Fauna and Flora, and render frequent revisions necessary. This want, a Committee of the Norfolk and Norwich Naturalists' Society, assisted by many gentlemen resident in the County, are endeavouring to supply, and I have now the pleasure of submitting to the Society the portion which has been committed to my care, viz., the Mammalia and Reptilia; this will be followed from time to time by the remaining portions for publication in their transactions.

In a highly cultivated County like Norfolk, where those animals not actually domesticated, or preserved by the sportsman, are regarded as "vermin" and ruthlessly destroyed whenever opportunity occurs, it is not to be expected that a great number of species will be found; but even the quiet which is maintained in our woods and coverts during the breeding season is favourable to the increase of some species, and the large tracts of reed-beds in the "Broad Districts," and on the margins of our sluggish rivers, afford protection and abundance of food for others, particularly for the Otter, which is perhaps more frequent than from its retiring habits and stealthy movements is generally supposed. There are two families, however, which are particularly worthy of attention—viz., the Cheiroptera and Cetacea; of the former, fifteen species are described as British by Bell, but we are only able to record five as occurring in this County. Our extended coast line, the most easterly sea-board of the island, has produced only eight well-authenticated species of the Cetacea out of a total of thirty described as British, by Dr. Gray; and although the majority of the species are of great rarity, it is probable the number recorded as belonging to Norfolk might be increased, and light thrown upon this interesting but obscure order, were those which occasionally come on shore, or get entangled in the shallows off our coast, more carefully examined. The reptiles do not receive the attention to which their great beauty and interesting

habits entitle them ; there is also the charm of novelty, and the hope of discovering something before unknown, with regard to their economy, to act as an incentive. In the aquarium and fern-case they may readily be studied and soon become most interesting pets. It is impossible to read Mr. Higgenbottom's admirable life history of the British Tritons* without seeing at once how much may be done for science by the careful study of a single family. I regret I am able to give little more than a dry list of the ten species of Reptiles found in Norfolk.

I have to record my obligations to Mr. J. H. Gurney for his kind assistance, and much valuable information to be found embodied in the list which follows ; also to Mr. Stevenson, who placed his notes, extending over twenty years, at my disposal ; the Rev. H. T. Frere, of Burston Rectory, Mr. W. M. Crowfoot, of Beccles, Dr. Lowe and Mr. E. L. King, of Lynn, and Mr. F. Norgate, of Sparham, have also supplied me with notes from their own particular districts, for which I beg them to accept my thanks. To Professor Flower, of the Royal College of Surgeons, London, my best thanks are due for his kind advice and assistance, particularly in the difficult Order Cetacea, rendered notwithstanding his pressing professional engagements.

MAMMALIA.

1. *VESPERTILIO NOCTULA* (Schreb). High-flying Bat.

Not uncommon throughout the County.

2. *VESPERTILIO PIPISTRELLUS* (Geoff). Pipistrelle Bat.

Common.

3. *VESPERTILIO NATTERERI* (Bell). Reddish-grey Bat.

Bell (*Brit. Quad.*, 1837, p. 42) mentions having seen specimens of this Bat, belonging to Mr. Yarrell, from Colchester and Norwich. Two in Mr. Stevenson's possession were killed at Framingham Pigot, near Norwich.

* Ann. and Mag. Nat. Hist., 1853, Vol. XII, S. S., p. 369.

4. PLECOTUS AURITUS (Geoff). Long-eared Bat.

Not uncommon throughout the County. A cream-coloured variety was killed near Norwich in 1870.

5. BARBASTELLUS DAUBENTONII (Bell). Barbastelle Bat.

Mr. Gurney has taken this Bat once at Easton; it has also occurred at Framingham Pigot, and several times at Beccles. Mr. Crowfoot found one on a wall at Ellingham, on November 2nd, 1870, and believes this species to be common in the neighbourhood of Beccles.

6. ERINACEUS EUROPÆUS (Linn). Hedgehog.

Common.

7. TALPA VULGARIS (Briss). Mole.

Common. Cream-coloured varieties are not infrequent. Mr. F. Norgate of Sparham, informs me that a large rusty-white variety was common at Oby; about ten years ago a shepherd sent him five males, they were cream-coloured above, rusty-yellow beneath, larger than the common mole, and seemed to have been fighting. Some of them had old scars and new short fur growing up.

8. SOREX ARANEUS (Linn). Common Shrew.

Common. Local name "Ranny."

9. SOREX FODIENS (Pall). Water Shrew.

Messrs. Paget (*Natural History of Yarmouth*) say this species is found in "marsh-ditch banks," and that it is "rather rare." Rev. R. Lubbock (*Fauna of Norfolk*) says it occurs, but not so generally as the common shrew. I have never met with it in Norfolk, nor has Mr. Gurney, who, however, once saw one from Oulton, near Lowestoft. The Rev. H. T. Frere saw either this or the next species in a pond at Roydon Hall a few years ago, but although he watched it for some time, he was unable to capture it for identification.

10. SOREX REMIFER (Geoff). Oared Shrew.

First made known as a British species from an individual taken by Dr. Hooker, in Norfolk. Mr. Gurney has met with this species at Keswick and Stoke Holy Cross, it has also occurred at Gillingham, Fakenham, Sparham, and Framingham.

11. MELES TAXUS (Flem). Badger.

At the commencement of the present century, the Badger was not uncommon in Norfolk; it is probable the aboriginal race is now extinct, and that those occasionally met with are either stragglers or descended from a stock introduced in consequence of their usefulness in forming earths for the foxes. In 1834, Messrs. Paget wrote—"Thirty years ago these were common, especially about Bradwell and Browston [Suffolk], but they are entirely extirpated." I find the following instances of the occurrence of the Badger in Norfolk: 1857, February 12th, adult, killed in the railway cutting near Brundall. 1860, March 9th, old female, at Hickling. 1862, January 4th, one taken alive at Intwood. This is the one referred to by Mr. Gurney, (*Transactions Norfolk and Norwich Naturalists' Society*, 1869-70, p. 25), as having been dug out of its burrow at Intwood. 1864, February 11th, an adult at Melton; and 1865, July 26th, a young male at the same place; 1868, one at Somerton. Mr. F. Norgate, writing in December, 1870, says: "About four years ago a gamekeeper told me he dug a badger out of a hole in the parish of Sall, (or Heydon?) and in a branch of the same hole was a nest of three young rabbits, alive."

12. LUTRA VULGARIS (Erxleb). Otter.

The otter is found occasionally on all the streams in the county, but its great stronghold is in the broads, where it is probably more numerous than is generally supposed; its retiring habits and the silent manner in which it glides into the water upon the first alarm enable it easily to escape detection. When the snow is on the ground their "seals" are often observed. In Mr. Stevenson's notes, kindly placed at my disposal, I find mention of no less than forty otters sent up to Norwich for preservation, between the years 1852 and 1867, and a bird stuffer in this city told me that in one year sixteen passed through his hands alone. The weight of a full grown Norfolk Otter appears to be from 18 to 28 or even 30 lbs, and the length from 44 to 48 inches; one fine fellow, killed during the present winter, on the ice at Ranworth, is said to have weighed 30 lbs., and measured 4 ft. 9 in. in length. The female does not reach so great a weight as the male. Mr. Gurney gives some interesting particulars of the habits of the otter in the *Transactions of the Norfolk and Norwich Naturalists' Society*, for 1869-70, p. 24.

13. *MUSTELA VULGARIS* (Linn). Weasel.

Common. The female is locally known as the "Mouse hunter." The weasel climbs trees with great expertness, in search of food or to escape pursuit. Mr. Gurney saw one which, when pursued, climbed an oak tree, and curled itself up on a branch fully thirty feet above the ground; he remarks, "that it seemed to climb as well as a squirrel."

14. *MUSTELA ERMINEA* (Linn). Stoat.

The stoat in Norfolk is called the "lobster," which it is suggested may have originally been "leapster," and have arisen from its habit of progressing by a succession of leaps or bounds; another suggestion is that it derives its name from the red colour of its fur. It is frequently found in the full white winter dress in Norfolk.

15. *MUSTELA PUTORIUS* (Linn). Polecat.

Although generally met with, by no means common in Norfolk. About Diss, the Rev. H. T. Frere finds it common; he says, "they seem to leave the lower grounds about October. I once caught seven, two old ones and five young, in a barn at Roydon. On two or three occasions I have turned out burrows on the Roydon fen, which have contained eels and frogs, generally half decomposed. I saw the tracks of several in the last snow."

16. *MARTES FOINA?* (Gmel). Common Marten?

Paget, writing in 1834, says, "the marten was formerly found at Herringfleet, but is now extremely rare." Mr. Gurney was informed by an old woodman that "Marten Cats" were found in Brook woods "during the latter part of the last century," and adds, "it is probably impossible now to ascertain to which of the two races of martens found in Great Britain those formerly inhabiting Norfolk belonged."

17. *VULPES VULGARIS* (Briss). Fox.

But for the protection afforded by sportsmen the fox would long ago have been extinct, as it is, frequent importations are necessary to keep up the stock; it can, therefore, hardly be said to exist in a state of nature. Probably the foxes found in Norfolk, previously to the re-establishment of the fox-hounds, were only stragglers. Mr. Stevenson tells me he was informed by Mr. Thomas Edwards,

that when the fox-hounds were given up in Norfolk, some of the foxes were trapped and sent into Leicestershire, Bedford, &c. Many of these, having been previously marked, were again trapped in Norfolk. Daniel, in his "Rural Sports," Vol. 1, p. 272, mentions a similar instance; foxes taken at Whittlebury Forest, and sent up to London after escaping from the hounds, were again trapped in their old haunts, and in one instance this occurred three times. The fourth time poor Reynard was killed, bearing upon him the signals of his former escapes. Mr Daniel also mentions the fact of a fox which littered in a hollow tree, twenty feet above the ground; and I am informed, that some of the foxes at Westaere, which I believe owe their origin to the continent of America, do not take to *earths*, but ascend fir trees, and lie on the top branches all day, thirty feet above the ground.

18. *PHOCA VITULINA* (Linn). Common Seal.

Not uncommon along the coast, particularly in the Estuary of the Ouse. Sir Thomas Browne mentions a seal killed at Surlingham Ferry, "having continued in the river for divers months before."

19. *PHOCA HISPIDA* (Cuv). *Pagomys foetidus* (Gray). Floe-rat.

In 1846, Mr. Gurney purchased a seal in the Norwich Fish-market, which was obtained upon the Norfolk coast; its skull, he informed me, was presented to our Museum, and as he was uncertain as to the species, he considered it worth investigating. Upon examining the skull, I found it differed in several respects from that of *Phoca vitulina*, I therefore submitted it to Professor Flower for identification, who expressed his opinion that it belonged to an individual of this rare Arctic species. On so competent an authority, I have much pleasure in adding this species to the Norfolk list, and in recording what I believe to be the first instance in which it has been recognized as occurring on the coast of Great Britain.

20. *SCIURUS VULGARIS* (Linn). Squirrel.

Common. Messrs. Paget include the *Dormouse* in their list of the mammalia found near Yarmouth, but as I am unable to confirm this, either from my own observation or through correspondents, I can only conclude it has vanished from its old haunts, and re-

luctantly omit it from this list, calling attention to the subject as worthy of investigation.

21. *MUS MESSORIUS* (Shaw). Harvest Mouse.

Somewhat local, but not uncommon. Mr. Norgate finds it frequent at Sparham, and has taken four or five nests in one day. At Gillingham, Mr. Crowfoot has taken its nests in the tall sedges by the side of the river Waveney, also in the marram grass on the beach at Kissingland, almost within reach of the sea spray. Two females brought forth young ones in captivity in the Lynn Museum.

22. *MUS SYLVATICUS* (Linn). Long-tailed Field Mouse.

23. *MUS MUSCULUS* (Linn). Common Mouse.

Both common.

24. *MUS RATTUS* (Linn). Black Rat.

Messrs. Paget in 1834, state "it still remains here though its numbers are gradually decreasing." Mr. Lubbock, in 1845, says it is "still occasionally found in the City of Norwich." Twenty years ago I saw one which was killed in the coal-house at the Lynn Subscription Library. It is now extremely rare, if not quite extinct, in this County.

25. *MUS DECUMANUS* (Pall). Brown Rat.

Common. Cream-coloured and pied varieties sometimes occur.

26. *ARVICOLA AMPHIBIUS* (Desmar). Water Vole.

Common in marshes and low ground. Mr. T. E. Gunn records the occurrence of the black variety of the Water Vole at Earlham in the summer of 1865 : *Zoologist S. S.*, p. 152.

27. *ARVICOLA AGRESTIS* (Flem). Field Vole.

Common. Mr. F. Norgate found the nest of this species containing six young, which were blind and naked, at Sparham, on the 27th of March ; it consisted of a ball of grass placed in a slight depression of the ground. Mr. Gurney saw a vole which was taken from a kestrel's nest at Earlham, and which, upon a cursory examination, appeared to him to be Mr. Yarrell's Bank Vole, (*A pratensis*.) As this species has not been observed in Norfolk, he thinks the subject worthy of attention. The Bank Vole recorded in the *Zoologist* for 1865, p. 152, is an albino variety of *A. amphibius* with malformed incisors.

28. *LEPUS TIMIDUS* (Linn). Hare.

Common. In Mr. Stevenson's notes several instances of the occurrence of a very beautiful variety of the Common Hare, with "fur like chinchilla," at Burnham Thorpe are recorded. As these notes occur in 1859, 1864, and again in 1866, it would seem to indicate something like a permanent variety in that locality. Mr. F. Norgate also mentions a similar variety, "light grey, very like the Alpine Hare in the transition state from summer to winter coat," as having been met with at Great Witchingham and West Lexham. He has also seen a hare with a black back at Sparham, and Mr. Gurney mentions a still more remarkable variety, perfectly black, killed at Denham, in Suffolk: (*Tran. N. & N. Nat. Soc.* 1869—70, p. 26.) Parti-coloured varieties are occasionally met with.

29. *LEPUS CUNICULUS* (Linn). Rabbit.

Very common. A beautiful variety known as the Silver Sprig has long been established in some localities, particularly on Thetford warren; black varieties also occur, and Mr. Gurney shot a rabbit on Corton Denes, Lowestoft, which was decorated with alternate black and grey markings like a cyprus cat.

30. *BALÆNA MYSTICETUS* (Linn). Right Whale.

Messrs. Paget mention "a small one taken near Yarmouth, July 8th, 1784." In an editorial note to Sir Thomas Browne's "Account of Fishes, &c. found in Norfolk and on the coast," (*Wilkin's Edition*, 1835, vol. 4, p. 326,) it is stated, a whale, (species not given,) fifty-eight feet long, was cast ashore at Overstrand about 1822, and another went spouting past Cromer in the autumn of the same year.

31. *PHYSALUS ANTIQUORUM* (Gray). Razor-back Common Fin Whale.

Messrs. Paget say—"Balæna physalis, fin-backed whale, has several times been seen and taken in herring nets."

1842, August 27th. One was taken in the Estuary of the Ouse, near Lynn, which measured forty-two feet in length.

1851, January 25th. Another taken in the same place measured eighteen feet. (Qy. *Balenoptera rostrata*.)

1857, January 12th. (Circa). One stranded on Winterton beach and killed by the fishermen measured forty-five feet. The skull of this specimen is preserved in the College of Surgeons' Museum.

1858, November 3rd. One taken off Wainfleet, on the Lincolnshire side the entrance to the Wash, measured thirty-two feet.

32. *BALÆNOPTERA ROSTRATA* (Gray). Pike Whale, Lesser Fin-Whale.

A whale, probably of this species, is mentioned in a note to Sir Thomas Browne's list, as having been cast ashore and killed at Runton, near Cromer, towards the end of 1829. It is described as twenty-four feet long, nose very sharp and pointed, nearly black on the back and white below in folds. Baleen nearly white.

In November, 1860, an adult male of this species was stranded on Overstrand beach; it measured twenty-five feet in length. The skeleton was presented by Mr. J. H. Gurney to the College of Surgeons' Museum, where it now is, and a full description is given by Mr. W. H. Flower in the *Proc. Zool. Soc.*, May 24th, 1864. Mr. Flower considers thirty feet the maximum length this species attains.

33. *PHYSETER MACROCEPHALUS* (Linn). Northern Sperm Whale.

Sir Thomas Browne says:—"A Spermaceti whale of sixty-two feet long, near Wells; another of the same kind, twenty years before [June, 1626] at Hunstanton; and not far off eight or nine came ashore, and two had young ones after they were forsaken by the water:" (*Wilkin's Edition*, vol. 4, p. 326.) I can find no modern record of the occurrence of this species on the Norfolk coast. In the Norwich Museum are skulls of *Delphinus euphrosyne* (Gray) and *D. delphis*, both probably obtained on the Norfolk coast, but I can find no history of either recorded. Sir Thomas Browne says of the latter species:—"sometimes taken, but many confound it with the porpoise."

34. *LAGENORHYNCHUS ALBIROSTRIS* (Gray). White-backed Bottle-nose.

Captured off Yarmouth in 1845, described, with plate, in *Ann. and Mag. of Nat. Hist.*, vol. 17, p. 21. Skull in Norwich Museum.

35. *HYPERODON BUTZKOPF* (Laccp). *H. ROSTRATUM* (Gray).
Bottlehead.

Under the head of "*Delphinus bidens*," Messrs. Paget say:—
"A large one caught in a herring-net, November, 1816; a smaller specimen about twenty years before." On the 22nd September, 1858, one of these whales was stranded on the "Ferrier Sand," at the entrance to the Ouse, which measured twenty-eight feet eight inches in length. Mr. E. L. King also informs me that two others of this species were taken on the 23rd September, 1867, near the same place; the larger one, a female, measured twenty-six feet eight inches; the smaller one eighteen feet six inches.

36. *ORCA GLADIATOR* (Gray). The Killer, Grampus.

Sir Thomas Browne mentions one measuring about sixteen feet in length, taken at Yarmouth about 1658. In July, 1823, a specimen, weighing four cwt., and eleven feet long, was found alive on Yarmouth beach: (*Paget*). In 1830 one was taken in Lynn Harbour, which measured twenty-one feet: (*Loudon's Mag. Nat. Hist.*, vol. 5.) And Mr. T. E. Gunn, in the *Zoologist S. S.*, p. 1927, records one being brought into Yarmouth Harbour on the 25th of June, 1867, which weighed fourteen cwt.

37. *PHOCENA COMMUNIS* (Lesson). Porpoise.

Common along the coast, sometimes coming up into the harbours.

REPTILIA.

1. *ZOOTOCA VIVIPARA* (Wagl). Common Lizard.

Frequent on heaths, hedge-banks, and dry places. Local name "Swift."

2. *ANGUIS FRAGILIS* (Linn). Slow-worm.

Not uncommon on heaths and in dry woods. The Rev. H. T. Frere finds it very common at Burston, and remarks a curious partiality displayed by it for some particular spot. "Every year," he says, "I see one or two close to one of my gates, and again on a particular grave in the Church-yard, in neither case is the favourite spot more than a square yard." In Norfolk, Mr. F. Norgate says, the slow-worm is called the "glow-worm," the real glow-worm being called the "glaze-worm."

3. *NATRIX TORQUATA* (Ray). Common Snake.

Not so common as formerly, but still abundant in places. This species takes to the water readily and is a capital swimmer, it is said to swim across Fritton Broad, which is nearly a mile in width. Mr. Gurney has frequently found the remains of toads in snakes which he has dissected.

4. *PELIUS BERUS* (Merr). Viper.

Frequent. Heaths and waste places. A red variety occasionally occurs.

5. *RANA TEMPORARIA* (Linn). Common Frog.

Common. The edible frog has been found at large in Norfolk, and claimed as an indigenous species, but there does not seem to be sufficient evidence to support the claim. Large numbers were imported and turned loose by Mr. George Berney in 1837, 41, and 42, previous to which time there is no certain evidence of their having been met with.

6. *BUFO VULGARIS* (Laur). Common Toad.

Common.

7. *BUFO CALAMITA* (Laur). Natter-jack Toad.

More local than rare, being found abundantly in many localities in Norfolk.

8. *TRITON CRISTATUS* (Laur). Great Water Newt.

Common. Locally the Tritons are called "Efts."

9. *LISSOTRITON PUNCTATUS* (Bell). Common Smooth Newt.

Common. Mr. Norgate has found them at night-time in winter by the road side "apparently migrating." Mr. Gurney sends me the following note on this species:—"Although this reptile may usually be handled with impunity, it is sometimes the fact that its skin possesses a noxious property which communicates a painful stinging sensation to the hand and arm of a person handling it, which does not abate for several minutes and seems very similar to that produced by handling the common jelly fish and other medusæ, some of which are more noxious than others.

"In the spring of 1869 a well-marked instance of this phenomenon in the Common Smooth Newt came under my notice, and I suspect that it may be more developed in the breeding season than at any other time."

10. *LISSOTRITON PALMIPES*. Palmated Smooth Newt.

Mr. F. Norgate has found this species at Sparham.

VIII.

Remarks on Mr. Leigh Hunt's "Birds of Thetford," as published in his History of "The Capital of the Ancient Kingdom of East Anglia."

BY H. STEVENSON, F.L.S.

It is greatly to be regretted that when, through the suggestion of Mr. Thomas Southwell, the members of the Norwich Naturalists' Society are endeavouring to collect materials from all parts of the County for the publication of correct lists of its Fauna and Flora, a work of so much pretension as the above, and devoted to the history of so important a locality, should, as far as the natural history portion is concerned, fall so far short of the requirements of the present day. That Mr. Hunt has laboured long and zealously to complete his self-imposed task there is no question, but in a work of this description, comprising so many different topics, historical, antiquarian, geological, and zoological, the author, unless possessed of super-human capabilities,—in short, an "Admirable Creighton" in literature—must needs fail in those departments with which he is least acquainted; but which, by a division of labour, as in Staey's and White's Histories of Norfolk, might have afforded reliable information.

I shall here deal simply with the Ornithological portion of the chapter (xxvi.), which Mr. Hunt has devoted to "The Natural History of Thetford;" but, inasmuch as the author, in a foot note, expresses himself as "largely indebted" to the *Birds of Norfolk* "for many of the *facts* supplied in the text," for the credit of that publication alone, I feel bound to notice the *fictions* which have been circulated in this.

Preparatory to commencing what he terms "a complete list" of the various kinds of birds in that neighbourhood, "together with their nomenclature, under the heads, *common, native, migrants, rare,*" Mr. Hunt remarks, "by this arrangement, the reader, learned or unlearned in the science, will possess a guide to the Ornithology

of the district, which, till very recently, was not obtainable but after a wearying pursuit and study." With this promise, at least, of completeness and accuracy, we come to the list of "Birds common at Thetford," divided under two distinct heads, *Natives* and *Migrants*, but strangely enough this "complete list" terminates abruptly with the *Columbidæ*; Partridges and Pheasants, even in that highly preserved district, are omitted, and the whole of the *Grallatores* and *Natatores* are summed up, afterwards, in a few lines of general comment.

If we examine this list, however, as far as it goes, conspicuous by their absence amongst the *natives*, are the Robin, Blackbird, and Hedge Sparrow, whilst in the list of migrants, I look in vain for the Swallow, Swift, House and Sand Martin, Ring Ouzel, Hobby, Merlin, Shorteared Owl, Sedge Warbler, Garden Warbler, and Grey Wagtail. Others may possibly be omitted, but these occur to me most prominently as I write. Even the common Sparrow forms no part of the list itself, but, in a separate paragraph we read, "These, with the sparrow tribe, *Passer montanus* and *Passer domesticus* complete (?) the list of common and well known species of birds." Thus making *Passer montanus*, the Tree Sparrow, and the ordinary House Sparrow equally common, although the former is, I have no doubt, not less scarce and local in its habits about Thetford than in most other parts of the county. I am well aware of the difficulty of dividing our so-called "British Birds" into two such arbitrary groups as natives (residents) and migrants, many exceptional cases presenting themselves requiring separate classification, or more minute subdivision: but why the Kestrel and Sparrow Hawk should rank amongst migrants *only*, and the *rare* Goshawk be placed (though under the head of migrants), amongst the birds "common at Thetford;" why the Red-backed Shrike, Spotted Flycatcher, Cuckoo, and Tree Pipit, which all breed with us, should be entered solely under the head of migrants, whilst the Nightingale, Blackcap, Whitethroat, Chiffchaff, Willow Warbler, Redstart, Yellow Wagtail, &c. are ranked both as natives and migrants, is as remarkable as that the Missel Thrush should not be considered as much a *native* as the Song Thrush, or the peculiarly British Pied Wagtail (*Motacilla yarrelli*) should be made a non-resident migrant. Again, though the Stonechat, Whinchat, Barn Owl, and Tawny Owl are, I believe, correctly

classed, as *natives* and *migrants*, yet the Skylark, Titlark, Chaffinch, Starling, Greenfinch, Hawfinch, Jay, and even the Rook, which all receive accessions to their numbers in autumn and winter, from more northern localities, figure only under the head of natives.

Passing on from the list of "Birds common," to the list of "Birds rare about Thetford," and which comprises, as Mr. Hunt describes it, those "migrants whose nests are seldom found amongst us, and those that never breed in this district," I am as little able to reconcile his statements with facts. The Peregrine Falcon is stated, and correctly so, to appear "*annually* in spring and autumn on its migratory course." Then why not have placed it in the former list, instead of the Goshawk, which is scarce and accidental? The Honey Buzzard, according to Mr. Hunt, is "occasionally met with in all the summer months, and *regularly* visits us [Thetford] in autumn, but it does not breed here." The first part of this paragraph is certainly correct as regards the county of Norfolk, but I know of no record of this species having been killed about Thetford, and consequently for its *regularly* visiting that locality in autumn, I should extremely like to know Mr. Hunt's authority. The Wood Warbler, again, appears amongst the rarities, yet is described as "a *regular* summer visitant, though not numerous," and being strictly an arboreal species, it was needless to add that it "*mostly* inhabits our woods." In like manner the Woodlark, which, though in small numbers, breeds regularly in certain localities in the neighbourhood of Thetford (being now-a-days almost entirely confined, through enclosure and cultivation, to the western side of the county) figures in this instead of the previous list, and is described as placing its nest "in similar situations to the Skylark." A strange comment upon the peculiar nesting habits of this particular species.

As before remarked, the Grey Wagtail, which regularly visits the banks of the river "Thet" in spring and autumn, is not included in the list of "natives and migrants," but the Grey-headed Wagtail, we are informed, is "*occasionally* seen on our warrens," though the statement is further qualified by the remark that "it is a rare bird in this district." So rare that at present only some half-dozen specimens are known to have occurred in Norfolk, and those, with but one exception, by the sea coast.

Scarcely less startling, also, is the announcement that Richard's

Pipit has "*occasionally* been seen both here and by the sea-coast." Will Mr. Hunt kindly supply the authority for this statement, as at present I am aware of but five examples of this rare Pipit having been seen in Norfolk, all of which were shot near Yarmouth. The Rook Pipit, included in the same paragraph, as "*occasionally* seen" about Thetford, may certainly have appeared there on its migratory course, as it has in the vicinity of Norwich, and the fact, if well authenticated, would be interesting; as well as further information as to the Lesser Spotted Woodpecker breeding and remaining, throughout the year, in that locality. Why the familiar Wryneck should rank with the Hoopoe and other accidental stragglers it is difficult to say, or why the Kingfisher should be classed in a similar manner, though described as "*now* frequently observed by our rivers, both in winter and summer, and generally breeds here." Considering its great persecution of late for the plume trade, I should have presumed that at Thetford, as elsewhere, this beautiful species would be found more scarce *now* than formerly.

Not a line is devoted to the past history of the Great Bustard, as a denizen of that very portion of the "Breck" district, nor is Mr. Bartlett's specimen of the Little Bustard, killed on the Warren, and still preserved at "The Canons," recorded amongst the rarities of that neighbourhood. Instead, however, I find amongst the brief notices of Gallatorial species the following strange announcements with reference to both the familiar and rarer kinds. Pallas's Sand-Grouse, unknown at Thetford, and (with the exception of a single bird killed near Lynn, in 1859) unknown in any part of Norfolk till the spring of 1863, and in no instance since that date—according to Mr. Hunt, "*occasionally* visits this locality." The Dotterel (*Charadrius morinellus*), a mere passing migrant, which breeds nowhere in England, is described as a "summer visitor, *occasionally* remaining to breed," whilst the Ringed Dotterel (*Charadrius hiaticula*), the most remarkable bird on the Thetford warren, owing to its habit, from time immemorial, of quitting the seashore in spring to rear its young far inland upon these dreary wastes, is described by this local historian as "an *occasional* summer visitant, and builds *in the fens*." The same authority, moreover, informs us that the Kentish Plover, Little Ringed Plover, (which has never occurred in Norfolk), and the Sanderling, all essentially shore birds, are "rarely seen here," but under what accidental circum-

stances, if at all (?) is not stated, and in like manner the Turnstone and Oyster Catcher are said to be "rarely found to visit this district."—So rarely, that I scarcely hesitate to assert they never have!! The Lapwing which, though in greatly diminished numbers, breeds annually on the warren, is only said to do so "*generally*," and the Norfolk Plover or Stone Curlew, which also still breeds there—as it did two hundred years ago, when Sir Thos. Browne of Norwich received one, in the flesh, "from about Thetford," and forwarded a drawing of it to his friend and brother naturalist, John Ray—is alluded to in the briefest form.

This fine species, however, is amply avenged for any slight experienced in the natural history portion of this volume, since in the chapter, (p. 265), on "Fossil remains found at Thetford," Mr. Hunt first quotes, as follows, from the work of Thomas Martin, "The historian of Thetford :"—

"Mr. Ray, in his preface to his *Collection of English Words*, printed in London, 1674, makes mention of a stone curlew, [Sir Thos. Browne's] which was found near Thetford, it had a remarkable eye, somewhat resembling that of a green plover."

And then adds, in a foot note,—by way of explanation and apology for Martin, whose "attempt," as he describes it, "in this important and interesting branch of science was so little successful," and whose "failure may be in great part accounted for from the fact that the science itself, in his time, was little known or understood :"—

This story of the "Stone Curlew" with its "remarkable eye" is a most marvellous one, and I fear, not founded upon careful observation. No doubt it was a peculiarly shaped flint, of which, there are a great many in our chalk pits. It must have been a remarkable eye that saw the fossil *curlew*.

Further comment is unnecessary when an author's knowledge of his subject thus falls short of the intelligence of any local shepherd or warrener.

XI.

MISCELLANEOUS NOTES AND OBSERVATIONS.

ON THE PELLETS THROWN UP BY ROOKS.—The fact that hawks and owls, indeed, all members of the raptorial order,—having no true gizzard, throw up, in the form of pellets, the indigestible portions of their food, is well known; but that this system is adopted by the rook (and I have reason to believe by the jaekdaw as well) will probably be received by our members as a new light, in the economy of so familiar a species.

When at Cromer, during the months of July and August, 1870, my attention was first drawn to this point by Mr. H. H. Upeher, who brought me from Sherringham several large, light-coloured pellets, which he had picked up on the cliffs in that neighbourhood, and which consisted, chiefly, of the husks of barley upon which the rooks had recently been committing much depredation. Naturally supposing that if these pellets were really ejected by rooks, the habit would by no means be confined to the birds of one locality, I searched the margins of the lighthouse cliffs, at Cromer, and there found dozens of them, always within ten yards of the edge of the cliff, and in such spots as I had seen daily frequented by rooks in some numbers. The largest quantity lay within two or three hundred yards of a barley field, on the Northrepps estate, and the feathers, both large and small, strewed about wherever pellets were visible, identified the rooks satisfactorily with these post-prandial deposits. The birds evidently, after a hearty meal of grain, retired to the smooth soft turf on the edge of the cliffs, and there lazily digested their food, other *excreta* invariably lying in juxta-position; whilst their leisure moments were devoted to the toilet, as shown by the feathers strewn around, and which, from the moulting condition of the birds, had been preened pretty freely from all parts of their plumage. Besides the

barley husks that formed the main portion, these pellets contained pebbles, some of large size, fragments of insects, chiefly wing-cases of beetles and in some instances (those taken at Cromer) minute portions of white egg-shells ; but from finding, close by, evidences of a recent picnic where hard boiled eggs had formed part of the fare, I have no reason in this instance, and so late in the season, to impute egg stealing to the birds in question.

On showing these pellets to a very observing gamekeeper on the Northrepps estate, he at once recognized them by the name of rooks, " Quids," and expressed his belief that wood-pigeons ejected similar though smaller pellets. It seems strange that this habit of so common a species should be so little known, another proof at least that British Ornithology is not an exhausted subject ; but with the exception of a note in the " Field," of August 11th, 1866, I know of no allusion to this fact in any work on Natural History.

Mr. James Barnes, however, the writer in the " Field " above alluded to, says : " I have for many years observed the rooks gleaning from our corn-fields and meadows immense quantities of food, secreting more than they can swallow in a pouch below the beak. They return to their roosting trees about five or six o'clock every evening, and there, amidst much noise and chattering, eject pellets of indigested food, consisting of the husks of corn and grass, earwigs, beetles, legs and wings of various moths, stones, pieces of lime, &c." Some of these pellets sent to the editor also contained numerous cherry stones, snail shells, skins of wireworms, and bones of a small quadruped, perhaps a shrew-mouse.

I have never met with these *debris* in any rookery, when shooting the young birds in spring ; but possibly the coarse and more miscellaneous substances that form their autumn diet, obliges them, at that season more particularly, to adopt this method of easing their stomachs. The pellets I examined measured generally from two inches to two-and-a-half inches in length, shaped somewhat like a boy's " tip-cat," the circumference in the middle being within $\frac{1}{8}$ th of an inch of the length. I have since found a tame jackdaw disgorge a portion of its very miscellaneous food in similarly shaped pellets, though very much smaller, and most probably the same habit occurs with that species in a wild state.

Mr. Upcher tells me he had once a tame jackdaw which took a

fancy to certain entomological specimens kept in his room, and if a drawer was left open where they were pinned out, he would swallow them, pins and all, but the remains were always thrown up afterwards in the pellet form.

ABUNDANCE OF QUAILS.—The chief point of Ornithological interest, in Norfolk, during the past year, has been the extraordinary number of quails met with by sportsmen in the early part of the shooting season, exceeding anything of which we have any previous record. Of late years this species has unquestionably decreased in this county, except in the now drained district of our western fens, but during the summer and autumn of 1870, they would seem to have been scattered over the entire county, and in the fens alone at least two or three hundred birds were killed and over a thousand eggs taken.

From the records of late in Natural History Journals it is evident that this extraordinary influx was by no means confined to Norfolk, and an effort has been made by the Editor of the "Zoologist" to obtain, if possible, a "census" of the quails observed during the past year throughout the United Kingdom, in order to form some idea of the numbers bred in this country, and of their general distribution. As shown by Mr. Dix's note in the "Zoologist," (*S. S.*, p. 2394,) the numbers killed in Pembrokeshire and Cardigan far exceeded even those in Norfolk, but certainly no other counties have afforded any similar returns. As to the cause of so extraordinary a flight of these continental migrants, alighting on the shores of Great Britain and remaining also to breed in such unprecedented numbers, I cannot at present venture to hazard an opinion.

Henry Stevenson.

NOTES FROM NEW ZEALAND. TARANAKI.—The story you refer to about our small birds having diminished in consequence of being stung by bees, is not substantiated. This much is true, that many tribes of birds, such as bell birds, green paroquets

(fantails), fly-catchers (nearly allied to tomtits,) have disappeared almost entirely, and also the tui or parson birds are very much diminished. I believe it to be owing to climatic changes. The year of the war appeared the silver eye or blight bird, and they have come every winter (till this, in which few have arrived) in immense flocks, feeding on the apple trees. They are pretty birds, very active, like the long-tailed tomtit of England, but are allied to the canary, and breed by thousands in the Chatham Islands. This last summer for the first time a species of swallow was seen here, and went away. They evidently come from the Middle Island, like the silver eye, for they were seen by a passenger on the route on a steamer. It is very true that bees have increased enormously in the bush; but I cannot believe they have stung the birds in the bill, as reported, or starved them by eating up all the honey in the millions of honey-producing trees in the forest. The great fire, I wrote about three years ago, nearly destroyed them; four days dense smoke from burning evergreen trees, severely tried human lungs, so the bees must have suffered also, to say nothing of their homes being reduced to ashes for miles of country. Before the war, in 1860, there were thousands of swarms in the bush, and nearly everybody in the country kept ten to fifty hives, and used the honey instead of sugar for all purposes, yet the birds did not diminish nor did I ever hear of any one finding a bird suffering from a bee-sting, or a rata tree without honey in its flowers! I suspect that terrestrial commotions have, for a time, at least, altered our climate. Since our last great earthquake our winds have altered in intensity, frequency, and direction. Report states that a great disruption of Antarctic ice has taken place, which to me explains the frequency of penguins, mostly young, being among the rocks here, and the capture of two sorts of seals—the common seal and sea lion, both young—close to the town, though they have never been seen since this was a settlement. The natives say they were common before the Europeans came, and they still call certain rocks on the beach by the names of the sort of seal that once frequented them. Our earthquake troubles are not over, and Tongariro has emitted enormous quantities of ashes, cinders, and black smoke. It is said all the fish have been poisoned in one of the lakes at the foot of the mountain.

Cuttle-fish, like the minaur on the coast of Normandy, have been thrown up with eight arms four feet long, and a single row of suckers the size and shape of liqueur glasses with the foot broken off; were any boys to be caught while bathing by one of these larger ones (small ones are common and used for bait) they would be certainly drowned; for it is not easy to paralyse by cutting the ganglion at the junction of the arm with the head, as they do at Granville, (Normandy.)

Further accounts indicate that many of the birds above spoken of are returning to their old quarters during the past year.

— — — *in a letter to the President.*





TRANSACTIONS

OF THE

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By Balance from last year ...	18	5	0
” 1 Subscription for 1870—1 ...	0	5	0
” 100 Ditto for 1871—2 ...	25	0	0
” Sale of “Transactions” ...	3	3	0
	<hr/>		
	£46	13	0

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	£	s.	d.
Printing “Transactions” for 1870—1 ...	£25	11	6
Less Professor Newton’s donation ...	4	6	10
	<hr/>		
Subscription to Museum ...	21	4	8
Mr. J. Quinton, jun., Assistant Secretary ...	2	2	0
Stevenson—Printing ...	4	0	0
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Balance in hand ...	1	18	4
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Examined and found correct,

T. G. BAYFIELD,
Auditor.

MARCH 25TH, 1872.

ADDRESS

Read by the President, HENRY STEVENSON, F.L.S., to the Members of the Norfolk and Norwich Naturalists' Society at their Third Annual Meeting, held at the Norfolk and Norwich Museum, March 26th, 1872.

LADIES AND GENTLEMEN—In fulfilling the final duty of my year of office, that of reviewing our proceedings during the past twelve months, I must congratulate myself on having been able to attend most of our monthly meetings, and take part, as well, in each of our summer excursions; being thus enabled to speak more confidently as to the interest excited by the various papers read, and the discussions which have ensued thereon. Though we cannot expect each year to supply our members with an equally tempting bill of fare—a condition of things, by the by, which we share in common with societies of established reputation, a renewed acquaintance with the contents of those papers, which form the bulk of our “Transactions” for 1871–2 assures me that the present volume will not meet with a less gratifying reception than its two predecessors. The important task which this Society has now in hand, that of compiling well authenticated, and, as far as possible, complete lists of the Fauna and Flora of this county, is progressing most favourably, even though the contributions made to this year’s “Transactions” in the department of marine, land, and fresh water mollusca, can be considered only as instalments by those able and zealous workers, Mr. F. W. Harmer and Mr. J. B. Bridgman; who are thereby desirous to draw attention to this neglected branch of our local natural history, and to solicit help towards the perfecting of their painstaking researches. Up to the present time, as Mr. Harmer informs us, the only list of our marine mollusca was that contributed by the late Rev. George Munford, to Wilson’s “Guide” to Hunstanton, comprising about

thirty species, but this number, by his own explorations, and the result of dredging along the shores of the "Wash," has been already increased to ninety-two. In drawing attention, however, to the remarks with which Mr. Harmer's and Mr. Bridgman's lists are prefaced, I must not omit to mention that the reading of each paper was illustrated by a very fine series of local specimens, and accompanied with observations on the edible qualities and habits of certain species.

As an evidence of the general, as well as local, interest that attaches to such county lists as we are now preparing, I may state that Professor Flower has recently published in the "Proceedings" of the Zoological Society, (part ii, 1871,) a very elaborate paper "On the Occurrence of the Ringed or Marbled Seal (*Phoca hispida*) on the Norfolk coast," in which he has traced, with infinite pains and trouble, the synonymy of that species, and pointed out the cranial differences which distinguish it from *P. vitulina*, and other larger forms. Now this paper, by one of the highest authorities in such matters, owes its origin to Mr. Southwell's admirable list of our Norfolk Mammalia in our last year's "Transactions." For although, according to Professor Turner,* this small Arctic Seal occurs in a fossil condition in beds of clay of the glacial period in the south-east of Scotland, it was unknown to the recent fauna of Great Britain, till the occurrence of a single specimen on the Norfolk coast in 1846; the particulars of which, with remarks on the life history of the species, will be found in our present number.

There are few of our members, I imagine, who have not read with deep interest in the last year's "Transactions," Mr. Barrett's paper "On certain Coast Insects found existing inland at Brandon, Suffolk," or who will not welcome the publication of his further notes on the same subject. This is but one of the many instances in which one branch of natural science throws light upon another, for Entomologists and Geologists alike may well ponder over the past history of these insect forms in connection with the post-glacial condition of their now abnormal habitat. Nor does the

* "Journal of Anatomy and Physiology," May, 1870, p. 260.

Ornithologist fail to profit by the researches of both, when he too finds a coast breeding Plover—the Ringed Dotterel (*Charadrius hiaticula*) of our shores and estuaries—annually passing inland, in small numbers, with the commencement of spring; there to perpetuate a race that from time immemorial has frequented those sandy wastes. These inland birds are identical in every respect with those which breed as regularly upon our sand hills, in close vicinity to the sea; but though the Plovers of the warrens migrate to the coast in autumn and winter, I can but express my belief in their hereditary descent from a race dating back to a not less remote period than Mr. Barrett's Noctuæ. From observations also, on the habits of other localised species, I would further hazard an opinion that with the death of the last of these warren-haunting Plovers would cease altogether the appearance of that species on the "Breek" sands of Norfolk and Suffolk. The birds bred on our sea-coast, though allied in every other respect, would not supply their place.

To Mr. J. E. Taylor, Secretary of the Norwich Geological Society, we are indebted for a paper, written at the request of our committee, upon "The Norfolk Broads and Meres Geologically considered," a subject of great interest at the present time, when the Fauna and Flora of both localities are being more closely and scientifically investigated than at any former period. Mr. Taylor's theory as to the origin of Meres, viz., glacial action, will no doubt be generally accepted—distinguished as they are from the so-called "Broads" of this county, by lying apart from rivers, at a considerably higher level, and deriving their water supply from the rainfall; but many will probably question the application of the erosive theory to the origin of the Broads themselves. For myself I would rather incline to the views of an earlier local authority, Mr. J. W. Robberds,* "that the Eastern valleys of Norfolk were formerly branches of a wide estuary, and that their present rivers and lakes are the remains of that large body of water, by which their surface was overspread *even in times comparatively recent.*"

* "Geological and Historical Observations on the Eastern Valleys of Norfolk," p. 62.

This idea has, moreover, been lately adopted by Messrs. Brady and Robertson, who, in their "Account of the Ostracoda and Foraminifera of tidal rivers,"* describe our Broads as "expansions of tidal rivers," now occupying "areas which were formerly depressions in the sea-bed."

A voluminous paper on "The Geographical Distribution of Animals and Plants, Geologically considered," possessing many points of great interest to the Zoologist, was also read by Mr. Taylor before this society, and has since been presented to the public in the pages of the "Westminster Review."

To our Secretary, Mr. Thomas Southwell, our thanks are due for a most entertaining paper on "Barnacles," in which he entered very fully into the mythical origin of the Barnical Goose, as described in the works of ancient authors, concluding with some valuable remarks upon the now acknowledged position of the Barnacle in the animal kingdom; a sub-class of Crustacea, the Cirripedia, including all the known species. By means of specimens exhibited, he also described the views entertained by Darwin and others as to their different stages of growth, means of reproduction, and other peculiarities. In deference only to his own expressed wish,—being considered by him unsuited to our publication, because not possessed of sufficient originality—has this paper been omitted from the "Transactions" of the year. It was in fact, written in accordance with the suggestion of one of our members, that a review of some scarce or little known work, might prove the foundation of an interesting essay, and in this instance Mr. Southwell took for his text-book Darwin's splendid monograph of the Cirripedia.

Mr. Kitton has again favoured us with a contribution towards the study of those lower organisms with which, as a microscopist, he is so intimately acquainted; and in directing special attention to his paper on "Sponges and the Spongy Origin of Flint," I may safely predict that it will command such an interest in our "Transactions" among strictly scientific men, as is due to the reputation of its author, and cannot fail to be gratifying to ourselves.

* See "Annals and Magazine of Natural History," July, 1870.

I regret that our miscellaneous notes should consist almost entirely of Ornithological subjects, as I cannot imagine that all the rare or noteworthy occurrences of the past year have been confined to that one branch of natural history. But, whilst inviting such communications from local naturalists, I may point with satisfaction to the announcements that appear under my own signature and that of Mr. J. H. Gurney, jun. The addition of so rare and beautiful a species as White's Thrush to the list of Norfolk birds, and the restoration of the Ortolan Bunting, on, I think, sufficient authority, to the same list, with the occurrence of two of our rarest migratory visitants, the Snowy Owl and the Lapland Bunting, must render the season of 1871 memorable in the annals of Norfolk ornithology.

Of our three excursions during the past year, I need say little more than that, favoured on each occasion by the weather, they were thoroughly enjoyed by the members who took part in them. The Horning Marshes, Surlingham Broad, and Scoulton Gullery, each afforded special objects of interest to the assembled naturalists, most of whom enriched their collections with entomological and botanical specimens. That Scoulton Gullery should have proved the chief attraction, judging by the number of members present on the occasion, will, I am sure, be no matter of surprise to those acquainted with that charming locality; and in compliance with the expressed wish of some of your Committee, I have had much pleasure in contributing a paper on the past and present condition of that ancient colony, to the present number of our "Transactions."

The inexorable hand of death, which claims its own from the youngest as well as oldest societies, has deprived us, within the last twelve months, of two of our most distinguished associates, Mr. E. C. Newcome, of Feltwell Hall, and the Rev. George Munford, of East Winch, near Lynn.

Mr. Newcome took a warm interest in this Society from its foundation, and readily consented to become one of its vice-presidents at a time when the addition of such a name to our list of patrons was all important to its success. As a naturalist and sportsman combined, he was surpassed by none in the thoroughness of his

acquaintance with the habits of the wilder and less known kinds of birds, that formed the chief object of his pursuit ; and as a falconer and promoter of that almost obsolete sport enjoyed a reputation by no means limited to this country. As an ornithologist, his opportunities for observation were only equalled by the accuracy with which his memory retained the minutest details as to the actions and other characteristics of his feathered favourites ; a gift which enabled him, in forming one of the best collections of British birds in the kingdom—the majority of which were preserved and mounted by his own hands—to give the stamp of ornithological truth to the attitude of each specimen, combined with the surroundings most appropriate to its habits in a wild state. Too fond of out-door occupations to place his own experiences on record, Mr. Newcome was ever willing to impart them verbally to others, and my own obligations are many for his friendly assistance in this respect ; indeed I cannot better close this brief memoir than by quoting the words of the Rev. Richard Lubbock, who, in a recent letter to myself, on the occasion of Mr. Newcome's death, remarked,—“ Of all naturalists I have met with, he was the most ready with information. Whatever he knew seemed to be packed ready for instant delivery on request.”

The Rev. George Munford, who had been in June, 1870, at his own request, elected a member of our Society, was well known as an accomplished botanist, devoted to literary pursuits. Amongst his published writings are many contributions to the “ Annals and Magazine of Natural History,” “ The Gentleman's Magazine,” “ The Zoologist,” &c. ; and of those on local subjects may be mentioned “ The Natural History of Hunstanton, cliff and shore ;” a Botanical History of West Norfolk, MS. ; Analysis of “ Domesday Book of Norfolk,” 8vo., published in London, in 1858 ; the botanical section of “ White's Norfolk,” 1863 ; “ Local Names in Norfolk,” 8vo., published at the request of the Norfolk Archæological Society, and others ; besides various theological papers testifying to his varied accomplishments and unceasing efforts to impart information in a wide field of literary research.

In seeking a subject upon which to found my concluding remarks

it struck me that I might appropriately draw your attention on the present occasion to the efforts made during the last few years to secure protection, in the breeding season, for certain classes of birds; more particularly as the preservation of indigenous species should be a primary object of all natural history societies. You will probably remember that in 1869, through the exertions of the "Sea Birds' Protection Association," and under the auspices of a Subcommittee, appointed by Section D. of the British Association, an Act was passed with that special object, whose penal clauses were framed to prevent the extinction of the various species which from time immemorial have frequented the rock-girt shores of the United Kingdom, for nesting purposes. This class of birds, including various kinds of gulls, with their close neighbours, the gullems, puffins, razorbills, and other rock fowl of the same precipitous coastlines, were gradually becoming exterminated. The yearly gathering of their eggs by adventurous rock climbers had had little or no effect upon their numbers, nor the occasional visits of collectors to procure specimens for natural history purposes; but so soon as railway communication was opened between the Midland Counties and the sea, whether at Flamborough and Bridlington in the North, or at Eastbourne and Beachy Head in the South, a war of extermination was commenced by "excursionist" gunners against this harmless, and, as I shall presently shew, in one respect, at least, invaluable class of wild fowl. The birds thus shot down, during the summer months, off the Yorkshire coast alone, have been computed by Commander H. H. Knocker, R.N., one of the chief promoters of that bill, at upwards of 100,000, "not for purposes of trade, but by pleasure seekers only." If to this amount we add the number of unhappy nestlings, suddenly deprived of parental care, and left to perish by a far more cruel, because lingering, death, we need scarcely wonder that in time such a system caused a perceptible diminution in their numbers. But, though in the first instance their persecutors accomplished their destruction for mere sport and pastime, leaving the worthless bodies to float to shore with the tide, the plume mania of the last few years added a fresh incentive to their pursuit; and whilst "contracts were

taken for the supply of thousands at a time," the utmost limit of ruffianism was reached when live birds were found "floating helpless on the water, with both wings violently torn off!!" Surely the time had arrived when Parliament was bound to interfere to stay such barbarity, and the petitions of naturalists and philanthropists throughout the kingdom for the enactment of a "close time" for these wretched birds, acquired a double weight from the fact that, on the Yorkshire coast, they had received the name of "Flamborough Pilots," their mingling cries, even on the darkest and most stormy nights, warning the mariner from too near approach to those rocky headlands. The fishermen, also, on the same coast, recognised the services of these birds, as unerring guides to the most productive fishing grounds.

The provisions of this bill,—which was warmly supported in the House of Commons by all the members for this city and county, and by Lord Sondes, and other local peers, in the Upper House,—applied but little to the birds of Norfolk; but, amongst others, protection was extended to the Grebes of our inland waters, and to the two or three species of Terns that still breed on our sea coast. Unfortunately, a clause originally inserted for the preservation of eggs, as well as birds, was thrown out in the House of Lords, thereby, as regards those last-named, materially impairing its benefits; since, unquestionably, the wholesale system of egging, carried on in this county, in years gone by, has done almost as much as gunners and enterprising agriculturists put together, to banish certain species from their former haunts. To the rock birds the omission of this clause was comparatively unimportant, the dangers attending the gathering of their eggs being a sufficient protection so long as their numbers were not sensibly diminished by other means. But I may instance the fact of three dozen eggs of the Common Tern (*Sterna hirundo*)—which is anything but common now on our coast—having been sent to Norwich a year or two ago from one locality only, as showing the necessity for some protection in this respect. At Salthouse also, a few years since, an ancient colony of the Lesser Tern (*Sterna minuta*,) was all but exterminated by a stranger who landed on the beach and shot every

bird that came near him, and took the eggs as well. The local gunners, who are accustomed to gather a few of the eggs for sale every season, told me this with great indignation, and were delighted to hear that these Terns would be included in the "Sea Birds" bill.

The marked success which has attended the passing of the "Sea Birds Protection Act," as shown by a report published in 1871, and supplemented as it was, so opportunely, by the tax upon guns, has induced its promoters to lay before Parliament, in the present session, a bill "for the Protection of Wildfowl," including many birds that form "a staple article of food and commerce," and which should command a "close time," therefore, for other reasons than the mere dictates of humanity. This bill, introduced by Mr. Andrew Johnstone, M.P. for South Essex, was read a first time in the House of Commons on the 15th of February, but its second reading is unavoidably postponed till some time in June.

In the present bill, under the general term of "Wildfowl," are included Snipes, Woodcocks, and Plovers, with the various kinds of Wild Ducks that still breed in this country, and which, notwithstanding the effects of drainage and cultivation, would do so more abundantly if left unmolested at the season of reproduction. The majority of these birds, coming partly under the head of game, have a recognised market value, and the considerable diminution in their numbers of late years, owing to their wanton destruction at the time when they have eggs and young, is a question affecting the community at large, and not merely the naturalist and the legitimate sportsman. I have elsewhere pleaded the cause of the Woodcock, which, though formerly recognised only as a migratory visitant to the Norfolk coast, has in this, as in other English counties, shown a yearly increasing effort to establish itself as a resident, and the praiseworthy endeavours of many landed proprietors to encourage this tendency require only such legal assistance as would be afforded by the bill. In some quarters remonstrance is of no avail. So long as the greed of certain sportsmen leads them to continue snipe shooting into April, to kill every woodcock that lingers in their coverts in spring, and to sacrifice even the wild duck that rises from her nest, only the penal clauses of

an Act of Parliament can effectually avert the mischief done by such individuals. Apart from the cruelty, however, of this unceasing persecution, the birds thus slaughtered during the breeding season are utterly worthless for the table; their flesh is tough and flavourless, and the females, heavy with egg, would be, one might imagine, better suited to the depraved taste of a Chinaman than to an English palate; yet our poulterers' shops, throughout March and April, and sometimes even in May, bespeak a demand for such delicacies, and mark at the same time the necessity for some legal enactment to stop the supplies. The bill, as at first drawn, proposed a "close time" extending from the 1st of April to the 1st of August, but the former date, I have reason to believe, will be altered to the 1st of March, the very latest at which protection should commence, owing to the early breeding of many of the species named. Throughout the present month (March) snipes, teal, and wild ducks have been hanging for sale in the Norwich market,* all killed in this county, though in many localities both snipes and wild ducks have been paired, and some of the latter actually sitting during the same period. Nor is this an exception to the general rule, or owing, merely, to the mildness of the season.

Now, as in former times, the amount of fowl exhibited in our own markets, in winter or spring, is no criterion of the number actually killed in the county, the Metropolitan markets absorbing the chief bulk of the supply. Within the last forty years a single game dealer at Yarmouth was accustomed to send on an average about fifty head of wild fowl per week to London, all killed in that neighbourhood, and this for a period extending from October to March or April; and though, at the present time, the supply, from all sources, is in strange contrast to the above, nevertheless dealers in Leadenhall-market have their agents in Lynn and Yarmouth, and rare and common birds alike, forwarded direct by rail,

* The value attached to that which is "out of season" will be seen by the following prices asked for birds, *out of condition*, both in the London and country markets:—Norwich, March 26th, 1872; Wild Duck, 5s. 6d. per brace; Wigeon, 2s. 9d.; Snipe, 3s. 6d.; Golden Plover, 2s.; Teal, 3s. 6d. Leadenhall Market: Wigeon, 1s. 6d. to 1s. 9d. each; Snipe, 1s. to 1s. 6d.; Woodcocks, 3s. to 5s.

under a general contract, can be purchased cheaper at the London stalls than from country dealers. To a favoured few the precise localities from whence these birds have been sent may be confided, but to the ordinary enquirer they will be Dutch fowl, however much their trim unruffled plumage may belie the fact. No inconsiderable number, also, of the birds killed during the spring months, find their way into private larders, and these must be taken into account as well as those that are exposed for public sale. Very many, also, that would otherwise remain to breed are driven to other climes by constant disturbance. To a bill, therefore, so obviously needed, I can see little fear of opposition, and it is gratifying to find all true sportsmen in favour of its provisions. Even the poulterers' interests would be better served by an Act, which would ensure far larger supplies in due season.

In the class of waders and wild fowl, however, it is not only for those most esteemed for the table that protection is sought, but for the Redshanks, Ruffs, Reeves, and Sandpipers of our marsh lands, and the Stone Curlew, Ringed Plover, and Lapwings of our heaths and warrens, the attractiveness of these to the eye and ear alike, in their several haunts, forming the best plea for their preservation. Notably amongst these the Ruffs and Reeves, once so plentiful in this county, are now limited to a few pairs in one neighbourhood only, whilst the Avocet, the Black Tern, and the Black Tailed Godwit, have all within the last half-century become extinct in our marshes, and, sad to relate, from preventible causes. It is time, indeed, that some steps were taken to avert further losses; and, locally speaking, I could wish that the Bittern had appeared in the list of protected species, this once familiar denizen of our fens and broads, though extinct for some years, having recently shown an inclination to become once more a resident. Now it is the preservation of such birds as these that most nearly affects ourselves, as naturalists, since from collectors comes the demand that fills our game dealers' and bird stuffers' shops with the finest specimens in summer plumage. So long as tempting sums are offered, we cannot wonder that gunners should be keen in pursuit, or that the Great Crested Grebe, the Ruff, and the Gargany Teal

should disappear from their breeding haunts, in spite of the efforts of landed proprietors anxious to preserve them. Can we wonder if the Bittern's nest is robbed, when we consider the sum which a recently laid Norfolk example of its egg would command, as compared with foreign specimens.

To avert opposition, the present bill has been drawn in strict accordance with the Sea Birds Protection Act, and hence no clause is inserted with respect to egging. From past and present experience, however, in this county, I can but regard the system before alluded to, of indiscriminate egging, as one of the main causes of the extinction of certain species. The robbery of marsh birds' eggs is no idle pastime of boys, but pursued by those well acquainted with their market value, and the readiest means of disposing of them. It is true, as Mr. Lubbock has stated, in his "Fauna of Norfolk," that "the desire to enclose all available land,"—originating from the extravagant prices caused by continued war, at the close of the last century, "struck the first blow at the feathered inhabitants of the waste;" but these changes were neither so sudden nor so extreme as to account altogether for the loss of two or three resident species. The Black-tailed Godwit, the Black Tern, and the Avocet, which have all ceased to breed in Norfolk within the last fifty or sixty years, were extinct before drainage had materially altered the physical aspect of their haunts, and may thus be said to have vanished through preventible causes. What those causes were is, I think, but too plainly evidenced by local records. On the authority of Messrs. Paget, we know that early in the present century, from the neighbourhood of Yarmouth, alone, between six and seven hundred eggs, per week, were sent on an average to the London market throughout the season; and that these were not Lapwings' eggs only, we have the testimony of Mr. Lubbock, who says "in those days various were the eggs that went to fill a basket. The Redshank, the Reeve, and various Terns were all put under contribution, their eggs, although smaller, being equal in point of flavour; and *being less inclined to lay again and more impatient of the theft* than the Lapwing, this system of robbery did them much more harm." Avocet's eggs at

Salthouse were gathered by scores to make puddings and pancakes, and the gunners actually *unloaded* their big guns at the birds, in wanton sport. At Hempstead, by Holt, the Stone Curlew's eggs were gathered in like manner, and the old ones shot, and the records as to the amount of Lapwing's eggs, yearly gathered in the fens, as well as "breck" lands, is scarcely credible by modern naturalists. So long, of course, as an impenetrable swamp, in places, formed a natural barrier between themselves and the egg gatherers, but little harm was done, and their numbers were not sensibly diminished; but when these areas became contracted, the birds less numerous, and the eggs sought for with still greater avidity, extinction became an inevitable result. Such, in degree, is the condition at the present time of various species, slowly but surely hastening to a like end, so far as this county is concerned. With our rarer species of birds (and the same remarks will apply as well to insects and plants) the more nearly are they exterminated in any British locality, the higher the price offered by the collector, and the greater the inducement to marshmen and others to procure all they can. Strangers from a distance, as well as local collectors, hasten the finale, and some, not content with filling their own cabinets, will buy rare eggs or ferns, as the case may be, in any number, as a means of exchange only for other *desiderata*. In one season alone upwards of seventy eggs of the beautiful little Bearded Tit were taken at Surlingham, solely for this purpose, and though abundant there twenty years ago, it is now rarely seen. The Swallow-tailed Butterfly (*Papilio machaon*,) and amongst ferns the beautiful *Lastræa cristata* may be classed in the same category, the latter, to my knowledge, having been all but exterminated in some localities, through the wholesale orders of London Florists. These and such like causes are beyond the control of Acts of Parliament; but I look to an influence arising out of the proceedings of such societies as this, to create an interest in the preservation of all indigenous species; and in the words of good old Thomas Bewick, with reference to the woodcuts of his "British Birds," I would add in conclusion, "In viewing their portraits SPARE AND PROTECT THE ORIGINALS."

I.

ON THE OCCURRENCE OF THE RINGED
OR MARBLED SEAL (*PHOCA HISPIDA*) ON THE
NORFOLK COAST.

BY THOMAS SOUTHWELL, F.Z.S.

Read 29th May, 1871.

THROUGH the kindness of Mr. J. H. Gurney and Professor Flower, of the Royal College of Surgeons, London, I was enabled to include this species in the list of Norfolk Mammalia, which I have just drawn up for our society. It is a species of considerable interest, both to the zoologist and the palæontologist, for although found in a fossil state in the glacial clays of some parts of the kingdom, I am not aware that its recent occurrence upon the British coast has before been detected.

The history of the individual in question is as follows:—Mr. J. H. Gurney in some notes on the Norfolk Mammalia, with which he kindly furnished me, remarked that he remembered purchasing a seal some years ago in the Norwich Fishmarket, the skull and skin of which he had preserved, and that as at the time he did not feel quite satisfied as to the species to which it belonged he thought the matter worth investigating. Mr. Gurney subsequently informed me that when he purchased the seal it was in the flesh, quite fresh and in a perfect condition; the fur was of a grey colour. The person of whom he bought it told him that it came from some neighbouring part of the coast, but the exact locality he does not now remember. The date of its occurrence was some time previous to June, 1846, probably in the spring of that year; it was also examined in the flesh by the late Mr. T. Brightwell, but I cannot find that he has left any note upon the subject. After some little search the skull was found to be in the Norwich

Museum, where it was deposited on September 14th, 1846, as the cranium of the "Marbled Seal."

On comparing this skull with such figures and descriptions of the crania of seals as I had access to, I found it differed from them all—notably from that of *Phoca vitulina*, in having the molar teeth arranged in a straight series, instead of each tooth being placed obliquely in the jaw, as in that species; the front part of the skull, too, was more depressed, and the ramus of the lower jaw differed considerably in form; although evidently belonging to a fully adult animal it differed from all, in being considerably smaller. Under these circumstances I asked Professor Flower's assistance, who kindly offered to inspect the skull, and the result of his examination was that, notwithstanding the extremely worn state of the teeth, rendered specific identification by means of these most marked features impossible, yet he was decidedly of opinion the cranium was that of the small arctic species, known as *Phoca hispida* (O. Fab.), *Phoca fetida* (Mull), *Pagomys fetidus* (Gray), the Ringed Seal or Floe-rat of the Northern Whalers.*

Although this species is not recorded as having been met with on our shores in the present day, it is quite possible that it may occasionally occur and pass unrecognized; that it was frequent on the coast of Scotland at one period, there is evidence in the abundance of the remains, referred to this species by Professor Turner,† which are found in the glacial clays of that country, from the presence of which he argues a degree of cold when these deposits were formed much more rigorous than at present.

Its chief habitat now seems to be the high latitudes of the Arctic Seas, especially parallels 76° and 77° north; in Davis Straits it is found all the year round, particularly up the ice-fjords; many, however, are said to be killed in South Greenland. They have several times been received at the Gardens of the Zoological Society, where I saw a pair a short time since, and in May, 1868, a young one was produced there by a female which was with young when brought to the Gardens. These specimens are

* A very minute description of this skull and an exhaustive synonymy of the species by Professor Flower, will be found in the proceedings of the Zoological Society of London, for June 6th, 1871, pp. 506—12.

† "Journal of Anatomy and Physiology," May, 1870, pp. 260—70.

generally said to have been taken in Heligoland, as I am informed by Mr. Bartlett.

Mr. Brown, in his paper on the Greenland Seals* gives much interesting information with regard to the habits of this species. He says by the whalers they are called the Floe-rat, and are found generally on the floes, or in the smooth floe-waters; they seldom frequent the open sea, but remain in the neighbourhood of the coast-ice, in retired situations; their food consists mainly of various species of crustacea and sometimes small fish. This species is the smallest of the Northern Seals, and of very little commercial value, its flesh, however, is eaten, and its skin forms the chief material of clothing in Greenland. A small seal is found in the now inland fresh waters of Lake Baikal, which in the opinion of some naturalists is identical with this species.

II.

SCOULTON GULLERY.

BY H. STEVENSON, F.L.S.

Read 29th September, 1871.

SCOULTON Mere, at the present time, as in years gone by, the chief nesting place of the black-headed gull, (*Larus ridibundus*) in Norfolk, is situated in the centre of the county, two miles from the town of Hingham, and about eight-and-twenty from the nearest point of the coast. The choice of such a locality indicates at once a marked peculiarity of this species, that of becoming, during the breeding season, essentially a *land* gull, consorting only in autumn and winter with the true sea gulls of our shores and estuaries. Our local historians, unfortunately, afford us no information respecting this interesting spot. Blomfield, as usual, is too engrossed with the church, its rectors and its monumental brasses, to notice any particular features of the surrounding country; indeed, so far as his record of the parish extends, we might doubt

* Proceedings of the Zoological Society, June, 1868.

the very existence of the Mere in his time, much less of that feathered colony for which it has so long been celebrated.

To Sir Thos. Browne, however, we are indebted for the fact, that Scoulton, and Horsey, near Yarmouth, were noted haunts, some two hundred years ago, of the *Larus alba*, or pewit gull, as, in his "Account of Birds found in Norfolk," he remarks, "great plenty thereof have bred about Scoulton Meers, and from thence sent to London." Further back than this we fail to trace any record of them, but, if the drainage of two of the Wretham Meres, (a former haunt of the same species of gull,) afforded evidence of the remains, in those waters, of "pile buildings"—the lacustrine habitations of a pre-historic race of men, (contemporary, in this county, with the red deer and the extinct *Bos longifrons*,) we need assign, I think, no narrower limit to the existence of Scoulton gullery, and may fairly speak of the ancient tenure of these birds as from time immemorial.

It would be idle to speculate upon the possible condition of Scoulton Mere and its surroundings at that remote period, but I question if the general aspect of the locality had much altered from the time of Sir Thomas Browne* until the close of the last century, when drainage and cultivation commenced those changes which have since reversed, in this county, the proportions of arable to heath, fen, and woodland.

We may picture the Mere in those days, with its central island or "hearth,"† as lying in the midst of a wild, open country, presenting, on a large scale, very similar features to the few "wet" commons still existing in Norfolk. On all sides a wide extent of marshy ground, dotted here and there with "pulk" holes and "plashes," each fringed with a rank growth of reeds and sedges, would be the constant resort of the lapwing, the redshank, and the snipe, whilst beyond, and rising gradually from the swampy level, the uplands, clothed with heath, furze, and braken, would extend over many hundred acres, as yet untouched by the plough—a rabbit warren, and nursery for the Norfolk plover, (*Ædicnemus crepitans*.) In wet seasons, the unbanked margin of the Mere would fail to contain its waters within their normal limits, and

* This learned physician and naturalist died in 1688.

† So pronounced at the present day in this locality, but the same word is written "haft" in Bewick's description of this species of gull.

thus a wide spread inundation, as still occasionally occurs on Wretham heath, would attract waders and wild fowl in unusual numbers to a diet of worms beneath the shallow flood.

In the absence, in those days, of any special protection, the dangerous character of the surrounding soil must have formed the chief safeguard against human depredations, for both eggs and young; and as, even now, a certain portion of the "hearth" is inaccessible to the egg gatherers, and the lucky pairs frequenting it rear their young in peace, so, formerly, a still wider area of impenetrable swamp, no doubt, formed the most eligible site on the island for laying in, or "lying in," purposes. To the spoliation by all kinds of four-footed vermin, as also by the larger birds of prey, with carrion crows and ravens, and even rooks in dry seasons, they were, of course, exposed in days long antecedent to extensive game preserving. Both nestlings and eggs, under these combined attacks, must have disappeared in large numbers, and many an old bird would fall a victim to the deadly swoop of the peregrine, nothing loth to pass a day or two, on its passage northward in spring, in close vicinity to that well-stocked larder.

In concluding this portion of my subject, however, I must not omit to mention that, whilst the eggs of these gulls have alone a marketable value at the present day, we have abundant evidence that in former times the young birds were taken as well in considerable numbers, and met a ready sale both in the provincial and London markets.

Sir Thomas Browne, alluding to their abundance at Horsey, says, "they sometimes bring them in carts to Norwich, and sell them at small rates; and the country people make use of their eggs for puddings;" whilst I have already noticed the same author's remarks, that those from Scoulton Mere were sent to London.

In the Northumberland "Household Book," amongst the special provisions for the table, we find, "It is thought good that seagulls be hadde for my Lorde's own mees, and none other, so they be good, and in season, at j^d. a pece, or j^d. ob. (three halfpence) at the moste;" *the same price then given for woodcocks.*

To show the extent, also, to which the traffic in these nestlings was carried, I quote the following, from an account of the black-headed gull, in "Grave's British Ornithology:"—

“Formerly this bird was held in esteem as an article of food ; they were taken whilst young, before they were able to fly, by driving them into nets, and when fattened on offal were sold for the table at five shillings the dozen ; and we further learn from Dr. Plott’s ‘History of Staffordshire,’ published in 1686, that fifty dozen were frequently taken at a driving, and that three drivings were generally made in a season.”

Having no personal experience of their edible qualities, I am unable to state whether a mere vulgar prejudice excludes such food from our modern *cuisine*, or whether the less pampered appetites of our forefathers caused even a nestling gull, “fattened on offal,” to be regarded as “a dainty dish to set before the king ;” but, inasmuch as Blomfield informs us that in the reign of Henry the Second the manor of Scoulton, Newlands, was held by Hugh de Burdeleys, and his immediate descendants, by “the Serjeantry of keeping the King’s larder,” it is more than probable that Scoulton gulls, by virtue of the “larderer’s” office, held an honourable position at the royal table.

To pass now to a description of Scoulton gullery as it exists at the present time, I must premise that the same condition of things, as I have here attempted to pourtray, continued, with but little material change, until the provisions of the Commons Enclosure Act were carried out in that parish, between the years 1805 and 1807, and thenceforward drainage and cultivation quickly circumscribed the boundaries of the fen, and the once barren uplands supplied better food than rabbits to the rural population.

About this date, the then proprietor of the Mere, no doubt foreseeing the destruction of the gullery, if not strictly preserved, planted the fine belt of trees which now encircles it, and formed the raised bank by the water’s edge, a mile and three quarters round, from which visitors are enabled to watch the actions of the gulls. But for such timely measures having been adopted, to keep off the egg stealers and the irrepressible gunner, Scoulton gullery, like those of Horsey, Feltwell, and others, would have been long since abandoned, and local naturalists would have been deprived of one of the most interesting sights in the whole county.

The water, as now confined within its banks, with the main island or “hearth” in the centre, cover over seventy acres, but the gulls do not breed on more than two-thirds of the extent ; the

upper portion, covered with small willow and alder bushes, and a soft mossy turf, having more attractions for the snipes, wild ducks, and teal, that regularly breed there; and the sedgy margin forms a shelter for the nests of coots, water-hens, and dabchicks. The breeding haunt of the gulls is on an oozy surface, covered, during the season, with a short growth of reeds, which effectually hides both nests and nestlings,—excepting those placed close to the water's edge, and a sprinkling of low bushes affords perching places for the gulls, notwithstanding their webbed feet. Occasionally even a bird may be seen upon the top of a flag-staff attached to a summer-house, on a small island, at the upper end of the Mere.

To form any conception of the swarms of gulls which here congregate yearly, for breeding purposes, it is desirable to visit the spot soon after their arrival, as the young reeds are then but of short growth, and the birds, just commencing their nesting duties, are more easily raised by the sound of the voice, to exhibit their full numbers. It is scarcely less interesting, however, later in the summer, to watch the nestlings just emerged from the shell, or, later still, the full fledged young ones, in their variegated plumage, sitting out on the open water, or on the grassy banks of the Mere.

The date of the arrival of these gulls at Seoulton in spring, varies somewhat with the mildness or backwardness of the season, a few having been seen, at times, by the middle of February, though they more commonly make their appearance about the first or second week in March. By the 18th of April the first eggs are laid, rarely more than three in each nest, and after the usual gatherings seldom more than two. For the first month two men are employed to collect three days a week, viz., Mondays, Wednesdays, and Fridays, picking up every egg they can find, and generally at the rate of from 1500 to 2000 a day; but when in full laying, and left undisturbed from Friday to Monday, between 3000 and 4000 have been taken in one day. This, as may be imagined, is no easy task, owing to the swampy nature of the soil, and the constant attacks of the gulls, who clamorously resent such treatment of their nests by incessantly dashing over the heads of the men, even striking their hats and faces with their wings.

In some places, as before stated, the condition of the "hearth" is so treacherous, that none but the birds themselves can safely

venture upon it, and the owners of the nests in such localities necessarily contribute their full complement of young to the general stock. In this manner from 10,000 to 20,000 eggs have been obtained in different seasons, and on one occasion even 40,000, but this occurred after they had been allowed a jubilee year, and been perfectly unmolested during one entire summer.

The nests, which vary considerably in height and general construction according to situation, are much flattened at the top, and loosely constructed of coarse flag and the withered stems of the last year's reeds, and are lined also with the dried leaves of the reed, partly obtained on the island itself, and partly from a stack of such materials left standing by the side of the Mere. In many cases, however, the eggs are deposited on some grassy tussock, a little lining only being placed in a depression on the top. The gulls will raise their nests, should the waters rise very much, and those situated near the edge of the island are commonly from half a foot to a foot in height. So closely are their nests placed in some parts of the "hearth," amongst the young reeds, that I have counted six or seven in a space of not more than three or four yards; and when one considers the general similarity of the eggs, and the still greater resemblance of the young, when first hatched, the power that enables each parent bird unerringly to discover its own offspring, is, with every allowance for the marvels of instinct, one of those things which no man can understand.

A few years back, a single pair built their nest in one of the small bushes on the island, and reared their young, but this eccentricity was neither repeated by them, nor their example followed by others.

As soon as the old birds are permitted to sit, and no further intrusion upon their haunts is permitted, the young are hatched in about a month, and as they swim most gallantly, even in their downy state, both young and old soon congregate upon the open water, and in large masses present the most beautifully variegated patterns, the brown tints of the nestlings blending with the grey, white, and black, of the adult birds.

In very dry summers, numbers of the young birds are suffocated in the mud as the amount of water decreases, and should the gathering of eggs be carried on too late in the spring, the greatest difficulty is afterwards experienced by the parent birds in procuring

food for their young. Owing to the severe drought in the summer of 1869, hundreds of young birds died literally of starvation, the old ones being unable, as were also the rooks at the same time, to procure worms and slugs for their sustenance; but, literally speaking, the dead fed the living, since the maggots from the bodies of the dead nestlings formed a scanty provision for those hatched later in the year. So great, however, were the privations of the parent birds, that hunger proved too much for even parental affection, and many wretched nestlings were left to perish on the island, through the old ones taking their departure for the coast several weeks before their accustomed time. Owing to the numbers which thus met with an untimely end, a partial jubilee was enacted in the two following seasons, and thus, in spite of very many being shot on the coast during the severe winter of 1870-71, the colony this last summer appeared as numerous as ever.

In ordinary seasons, by the end of July, the young have acquired their full powers of flight, and towards the middle of August prepare to quit their breeding place, and with their parents betake themselves to the sea coast; and from that time until the following spring, not a single gull can be seen in the vicinity of the gullery, their incessant cries, which cease neither day nor night, giving place to a stillness and a sense of dreary desolation which must be felt to be fully realized.

The eggs of these gulls, which are generally considered as a great delicacy when eaten cold, like lapwing's eggs, are now sold on the spot at from 9d. to 1s. a score, but in 1825, according to Messrs. Sheppard and Whitear, they fetched only 4d., and the person who had then the right of collecting them paid £15 a year for the privilege. The package and transmission of such large numbers to the different markets in Norfolk and other parts of England is, of course, a business of itself, requiring no little care and skill on the part of the keeper. The close resemblance of many of these eggs to those of the lapwing or peewit, causes them to be not unfrequently sold in the market as plover's eggs, more particularly since the latter have become more and more scarce, and the very term "Peewit" gull, applied to this species, aids the deception, and renders the general public more liable to be gulled. In looking over a large series, one is struck with the extraordinary variation in the coloring matter from the normal tints of green and

brown to light unspotted blue. Amongst them also are found, as with the eggs of domestic fowls, a considerable number dwarfed and misshapen to a strange degree; but whether these are to be considered as exceptional only, in a natural sense, amongst the hundreds of eggs gathered, or are in any way attributable to the systematic robbery of those first laid, I am not prepared to say.

Notwithstanding the watchful care of the keepers, the young, as soon as hatched, have many dangers to contend with besides the chance of suffocation, or a scarcity of food, as it is almost impossible to extirpate the rats, weasels, and other vermin, which are irresistibly attracted by the strong scent of the birds. Nor are the nestlings much more safe on the water than on the land, since they form a tender morsel for a hungry pike, and eels have been known to attach themselves to these swimming puff-balls, and sink with them to the muddy depths of the Mere.

So much, then, as to the nesting habits of the black-headed gull, which, for a considerable portion of the year, as before stated, is essentially a *land* gull, following the plough in search of worms, grubs, and insects, and even small mammalia; and being thus in every way the farmer's friend, deserving at his hands of every possible protection and encouragement.

Occasionally they have been known to devour small birds when pressed for food, but, as a rule, I believe, their carnivorous tastes incline rather to felt than feathers, and so fond are they of mice, that they will catch them when thrown up into the air with wonderful dexterity, rarely allowing them to fall to the ground. They have also been seen on a summer's evening hawking for cockchafers under the shade of lofty elms, and the various small moths that swarm around the sedgy borders of the Mere are favourite objects of pursuit.

As before stated, at the close of the breeding season, young and old betake themselves to the sea coast, where, throughout the autumn, they are by far the most abundant of the smaller gulls that seek their food upon the muds and sand banks of our tidal estuaries; and even in the most severe weather they may be seen in flocks upon their accustomed feeding grounds.

I have reason, however, to believe that very many also pass southwards in the autumn and winter, from the fact, that when, as happens not unfrequently on dark autumnal nights, immense flocks

of golden plovers and other migrants are heard whistling and calling over this city, attracted by the glare of the lamps, the harsh cries of this gull, apparently in considerable numbers, may be readily distinguished at times; and there can be, I think, no question that a migratory movement is then taking place.

The black head in this species is peculiar to the breeding season, a slight patch only on the nape of the neck existing in its winter dress, and, as is customary with all gulls, the young are two, if not three, seasons in acquiring their full plumage.

I never yet saw a mottled bird at Scoulton on their first arrival, and it is rare even to see one with a black bar at the base of the tail, the last stage of immaturity; but though in this state, they have been known to breed, still, as a rule, these birds do not seem to pair off or frequent their nesting stations until they have acquired their full adult plumage. This, no doubt, accounts for the numbers seen throughout the summer on all parts of our coast, feasting their idle hours away, till in due time (provided always they keep clear of ladies' hats), the joys, labours, and anxieties of the nuptial state are theirs, and with a burst of parental indignation they witness for the first time the inevitable robbery of their new-laid eggs.

III.

THE NORFOLK BROADS AND MERES GEOLOGICALLY CONSIDERED.

BY J. E. TAYLOR, F.G.S.

Read 31st October, 1871.

MR. PRESIDENT, LADIES, AND GENTLEMEN—It is only since I seriously began to look for materials in the composition of the present paper, that I became aware of the importance of the task I had undertaken. So little has been said on the subject, that I am almost in the unpleasant position of being the first to open it for discussion. If my remarks should have the effect, whether directly or indirectly, of giving us more light on the subject of the

origin of our Broads and Meres, I shall deem myself amply rewarded for any trouble of mine.

It falls within the legitimate province of Geology to account for the aspects of physical geography by a reference to bygone operations. There is not a single element in this important science which is not due to those principles which form the very vitality of geology. Whether in the upheaving forces which have made one part of the earth wildly mountainous, or in the denuding agencies which have cut another area down to the general flatness of the Fen districts, we must recognize in both the effects of agencies which have been in operation for ages. We, in Norfolk, are fortunate in being able more or less completely to connect the later tertiary deposits with each other, and hence it is, that one of the most interesting chapters in later geology is to be read of in the Eastern Counties. The physical aspects of the Broad district—to take that first—are, I suppose, tolerably well known to all present. They are aware what a paradise it is to the naturalist, what treasures of birds, plants, and insects, its peculiar geographical character supports. Between this part of Norfolk, and the opposite coasts of Holland, there is such a striking likeness that, for artistic purposes, the former may be regarded as a portion of Holland which has been broken off, and floated across the German Ocean hither! The sluggish rivers wind for miles out of their straight course, owing to their small fall, and, in the valley of the Bure especially, we have a string of water expanses, termed “Broads,” which bound the course of the river on this side or on that. The small fall of the river—only two or three feet—at once tells us that the rivers themselves have not scooped out the basins in which the Broads lie, indeed, as we shall see further on, there is a greater tendency on their part to fill up such basins than otherwise.

The Broad district is a county *sui generis*, with the exception of its cousinly likeness to the Dutch Fens. It is to the consideration of the geological causes which have been operative in producing such a result, that I now beg to draw your attention.

As I before remarked, it is necessary at once to refer to a period long antecedent to the present, in time, although geologically its immediate predecessor. You are aware that this period is that commonly known as the “Glacial Epoch,” when Britain was dis-

tinguished for the long northern winter under which she laboured, a winter so intense and prolonged, that arctic circumstances, physically and zoologically, prevailed in the place of that more genial climate under which we now live. It was at this period that England underwent the last great physical change. We have abundant proof that Norfolk must have been submerged to at least six hundred feet below its present level. Previous to that—with the exception of the muddy deposits brought down by a large river on the continent and strewn over a portion of the chalk, so as to form the black soil of the “Forest Bed”—Norfolk was a continuous and uneven bare sheet of chalk, which had long been exposed to atmospherical wear and tear. In the pre-glacial epoch, this chalk sheet was roamed over by herds of deer, elephants, mastodon, &c., and a great estuary cut through it from a southerly direction, on the floor of which was formed our well known “Norwich Crag.” One cannot but reflect on the difference between the land surface of the county in Pliocene times, and that of the present epoch.

It was during the great depression to which I have referred, that the thick beds of sand, gravel, clay, brick-earth, &c., were thrown down and accumulated, in some parts to nearly three hundred feet in thickness. Thus was the old land surface, with its rubble of flints, left by the decomposed chalk, associated with the teeth, tusks, bones, &c., of extinct animals, covered up beneath an overlying sheet of drift. This sheet must have been more or less continuous, with just such variations in its thickness as would be the result of currents.

Then we have the period of elevation, towards the close of the glacial epoch. It was no sudden phenomenon, but a process perhaps as gentle as that which is even now elevating the northern shores of the Baltic. At length the marine muds and sands, in their soft condition, were brought under the influences of eurrent and tidal action. As the upheaval went on, these could not fail to leave their marks on the rising area, in the shape of valleys, re-deposited material, etc. We have a good illustration of this in such of the latest glacial beds as the sheet of large, rounded boulders on Mousehold, which represent to us a thick stratum whose finer particles have been carried away, leaving this ancient shingle heap to accumulate in consequence. — The upheaval went on until

England was connected with the continent, so that the relative position of land and water may have been some hundred and fifty feet in difference. The general aspects of Norfolk would not be unlike what they now are in many respects. The marine action had scooped hollows in the accumulated drift beds, and, in many places, had cut through them right down to the solid chalk. When the land stood higher, the water fall must have been more rapid, and the denudation more effective. Hence atmospherical wear and tear rendered still more palpable the initiatory hollowings of valleys first produced as the land arose above the water.

I believe that it is during this stage of Norfolk history, that we have the origination of our Broads. Not that the latter were what we now see them—but that the agencies which scooped out the hollows in which the waters of the Broads now lie, were then in action. Those agencies I believe to be the effect of land ice. We have abundant geological evidence that the climate—although not so rigorous as it had been—was still much colder than it is at present. The Rev. Osmond Fisher has pointed out that the January isothermal of 32° approaches nearer to this part of England than to any other, and he draws the inference from this, that the glacial cold might have lingered longer here than anywhere else, and that its effects may have resulted in external physical action. The accumulations of valley gravel on the flanks of the valleys of our rivers, testify to the rigorous climatal conditions then in force to produce them. During the winter season it is probable these valleys were charged with ice-floes, which would assist in widening them. Let it be remembered, that I am speaking of a time when the area of the Broads was at least one hundred and fifty feet above the sea level. The German Ocean did not exist, so that the present debouchure of our rivers could not have been openly into such a sheet of water. The ice which lay over what is now the Broad district, in moving along the excavated valley, would scoop out just such depressions as these we see. Professor Ramsay and most of our best geologists assign the formation of the Swiss, Italian, Scotch, Welsh, and Cumberland lakes to the effects of ice. This ice, in descending from the adjacent high mountains where it accumulated as glaciers, exercised the greatest degree of erosion or scooping out power at their bases. Hence the general position of these great lakes all over the northern hemi-

sphere. We had no such mountains in Norfolk, but if the area where the Broads now lie was one hundred and fifty feet above the sea level, it will follow that those parts higher still (our present water-shed) remained in the same relations as they do now. Hence our lakes or Broads were smaller and shallower, simply for lack of that mechanical force derived only by glacial descent from very elevated regions. As it is, the depth and extent of the Broads I consider to be directly proportioned to the operating effects of the ice from the higher levels.

We know that during the connection of England with the continent, the climate was rigorous, because it was now that arctic plants migrated, and took up their position wherever it was possible. As the climate toned down these were obliged to ascend the mountain and hilly ranges, where alone they could find a cold suited to them, and similar to that which had maintained them in the plains previously. That the climate became warmer before our island was separated from the continent, is evident by our prevailing flora, as well as fresh-water and land fauna, which differ in no respect from the general European types.

Zoologically, therefore, as well as geologically, we know that England has been severed from the rest of Europe, since the glacial period, and within comparatively recent times. The German Ocean is but of yesterday, in comparison with other seas. Mr. Godwin Austen has shown that an elevation of no more than one hundred and twenty feet would once more lay bare its sea bed, and connect us with the continent from Flamborough Head by way of Heligoland to Holstein. The deepest part of the sea is that known as the "Deep Water Channel," which runs more or less parallel to the coasts of Essex, Suffolk, and Norfolk, and has a maximum depth of one hundred and eighty feet. In case of an elevation like that above-mentioned, this would become the bed of the Thames, and it is probable that it was the course of some such river before England became an island. In that case, the rivers flowing down the Norfolk valleys would be tributary to it, and the extinct river whose dried up bed may be seen in the Mundesley Cliffs, may have been a similar minor tributary during post-glacial times. The North Sea has an average depth of two hundred fathoms, or twelve hundred feet, so that this must have been a sea ages before the German Ocean was formed, and, in fact, that into

which the great river running along the "Deep Water Channel" emptied itself.

It may be inquired why I assume a higher elevation of Britain during the post glacial period. In the first place, I point to the zoological features common to this country, and those across the Channel, and to the fact that their community, and the possibility of migration hither could not have taken place until after the severe cold of the glacial period had passed away. The shallowness of the intervening sea is another indication of its recent origin. But I think we have, at Yarmouth, a very good proof of the land having stood higher subsequent to the glacial period, and of the recent severance of England from the Continent. Underneath the Dene sands we have a stratum of *recent* estuarine deposits, to which my attention was kindly drawn by Mr. Fred. W. Harmer. These are one hundred and twenty feet in thickness, and therefore indicate the gradual depression of the land to that depth whilst they were forming. They equally point to the encroachment of the North Sea over what were then the lowest lying lands, until the German Ocean occupied its present site.

As the latter process took place, we should have a gradual alteration in the arterial drainage of the next low-lying area. The depression which took place whilst the Yarmouth estuarine deposits were forming, had it continued, would have occupied the entire area of the Broad district, and thus produced a very different coast line to the present. As the land gradually settled down to its present level, the hollower portions would then be filled with water, and become Broads. As a rule, these natural lakes are distinguished by always being connected with a river, either by means of a broad natural dyke, or by the river running through them. Most of them are hollowed out of the chalk, the erosion of which I spoke having cut away all the drift strata down to this parent rock. Surlingham, South Walsham, Wroxham, Ranworth, and many others, have all a chalk bottom. Over this there has accumulated a stratum of mud, which, in those Broads standing off the river, is very thick.

In such places as the little Broad, at South Walsham, where there is a scour by the current, the mud is absent, and the water in many places fifteen feet deep. The deepest Broads are always those where the current is in action, and the shallowest where it

is not felt. In Heigham Sounds we have an accumulation of twenty feet of mud. During the winter, the floods bring down great quantities of mud, and the surplus water fills the Broads, and precipitate it along their floors, except in those where the current is strong enough to prevent it by carrying it away. Hence it is that our Broads have become shallower. The rich mud and the shallowness have favoured the growth of the aquatic vegetation, and thus deposition and carbonaceous accumulation have every year been doing their utmost to fill up and contract the areas of these lakes. My friend, the Rev. John Gunn, has given a lucid account of the rapid growth of peat along the margins of the Broads, in his Essay on the "Geology of Norfolk," and we all know what excellent opportunities such a careful observer has had of recording the facts. Whilst the average rain-fall of the county is not quite twenty-five inches, Mr. Hawkshaw tells us that it has been found, from actual experience, that the evaporation from such Broads as that of Ormesby, is not less than thirty inches. This, again, favours the process of filling up.

It is very evident that, just after the severance of England from the Continent, our Broads must have been very different things to the shallow, contracted objects they now are. The marsh land on either side the Yare, down to Yarmouth, when dug into, is seen to be nothing more or less than *drained peat*, more or less full of fresh-water shells. In fact, the whole of the low-lying land must have been covered by water, especially as the tidal back-water is now considerably diminished since the sandbank on which Yarmouth stands became solid land, and no longer an island. The lower parts of this great valley have undoubtedly been filled up at least six feet, within comparatively recent times. Breydon has been silted up four feet within the last half-century, but that is due to peculiar causes.

No wonder that, when the adventurous Danes felt their way up these estuaries, they should have christened the villages on their banks with those terminations of "by" and "wic," which at once indicate their original naval character. I must protest, however, against the general idea that "the sea came up to Norwich." It was simply that there was more water, and that perhaps backed up higher, for in digging for the sewerage works at Trowse, and elsewhere, though the peat passed through was five or six feet

thick, and full of shells, the latter were all of fresh-water species, and there did not occur any of a marine character. Our Broads are outliers of this former hydrographical system, and they occupy those spots where the erosion had been most in operation.

There can be little doubt that the word "Broad" comes from the Anglo-Saxon "*Bradán*"—to make broad—a word which we have retained as a proper name when speaking of the largest of these expanses, as for instance, *Breydon*, near Yarmouth. But this word, being Saxon, shows us that our Broads existed separately and specially in those days, therefore the whole of the valleys could not have been entirely filled with shallow water at so late a period.

The largest number of the Broads is situated in the Bure Valley, where we have twenty-two of all sizes, whose names and acreages (the latter ascertained by Mr. Grantham, C.E.) are as follows:—

	Acres.
Ormesby, Filby, and Rollesby ...	464
Walsham	62
Ranworth	117
Little	13
Decoy	22
Salhouse	22
Burnt Fen	11
Hoveton Little	57
Hoveton Great	121
Wroxham	92
Bridge	12
Belagh	12
Catfield	22
Oliver	23
Barton	229
Stalham	75
Dilham	17
Hickling and Whitesley	578
Womack	25
Chapman's	46
Martham	115
Horseý	130
Calthorpe	13

Some of the latter are situated on the tributary stream Ant, and on the Hundred Stream. The Broads on the Yare are only four in number.

Perhaps the reason why there are fewer Broads on the Yare than on the Bure, is that the average breadth of the former is much greater than that of the latter. The general breadth of the Yare is 150 feet, and that of the Bure, 100 feet.

These are as follows :—

					Acres.
Buckenham	...	...	...	...	20
Strumpshaw	...	...	..	...	17
Rockland	...	...	...	...	117
Surlingham	...	...	..	..	104

There is also a small Broad at Hassingham, near Buckenham, on the opposite side of the river to the two last mentioned. Breydon has an acreage of 1200 acres.

To sum up—the physical characters of the Broads are distinguished from the Meres by being always situated on or near rivers, and therefore they occupy the lowest level. Their bottoms, when denuded of their muddy deposits, are generally of chalk.

I am afraid I have drawn largely on your patience in thus entering so minutely into the circumstances under which they were formed, as well as into their antiquity. My only apology is that I found it so entertaining, that I could not leave off before.

With regard to the Norfolk Meres—the origin of the name is so palpable that I need not stay to mention it.

The Meres are not by far so numerous as the Broads, and they are distinguished by the following physical characters :—As a rule, they are situated on the upper boulder clays, as at Seoulton, Wretham, and elsewhere, and therefore occupy higher levels than the Broads. They are not in connection with any rivers, and rarely with even small streams. They occupy the lower parts of the district, and are fed by small runnels during rainy weather. Hence they frequently dry up during a season of drought, their water supply being simply the storage of the wet seasons. I do not think many of the Meres are fed by springs. If they were, the springs would have to issue from the drift sand which usually lie underneath the boulder clay, and I think a communication like this would be much more likely to let the water out, than to pour it in.

Again, springs are frequently active during seasons of drought, as the interval of time between the original rain-fall and the drought has been occupied in percolating through the strata. Of all the Norfolk Meres; that at Diss is the most remarkable. It is very deep in some places, over twenty feet, and must have been deeper originally, as the water poured into it has undoubtedly helped to fill it up by the deposition of sedimentary matter. There can be little doubt that the formation of Diss Mere is due to glacial action, which has cut down all the overlying beds into the solid chalk, and left there the present remarkable basin-shaped depression. The entire neighbourhood of Diss has been subjected to peculiar glacial action, as may be seen in the ploughed-out and contorted drift beds, and I regard the hollow in which the Mere lies, as one among these phenomena. With the exception of being cut down to the chalk, Diss Mere in all respects answers to the rule laid down. Scoulton Mere is easier to understand. Its waters are shallow, and we know that time was when a greater area of the district was a swampy marsh, not unlike the island which now occupies the centre of the Mere. Cultivation has gradually contracted this area, until all that remains of it is the present state of things. The Mere is situated on an extensive and continuous sheet of boulder clay, on which rest several natural lakes of greater or less size.

At lower levels, in the Fen districts, we have Meres, as, for instance, the well-known one at Whittlesea, now drained. These lie on the Kimmeridge clay—a formation considerably older than our chalk—which crops up beneath the Fens. It is quite as impervious to percolation as our own boulder clays, and thus produces similar physical resemblances. The Fen district owes its swampiness to the underlay of this particular stratum, and the prevalence of the termination of its village and town names of “ea,” and “ey”—the Saxon words for island—indicate to us the condition of things a thousand years ago.

Meres are also common to Cheshire, where they usually lie over that formation termed the *keuper*. It is in this that the thick beds of rock-salt occur. That salt is being gradually dissolved away by percolating water, which issues to the surface as brine springs. Hence the overlying rocks, in many places, are depressed, and then form hollows into which the superficial water drains, and forms the well-known Cheshire Meres.

I have no doubt that many of the "tarns," or smaller Meres, so common on our boulder clays, or "heavy lands" as they are commonly termed, have been formed in a similar manner.* Water, in draining through chalk, will form the well-known "sand-pipes," by dissolving portions of the carbonate of lime away. I have seen sand-pipes so formed, which have been thirty yards across. The matter thus hollowed out and carried away is replaced by a subsidence of the overlying beds, which then form the basin for a small Mere or tarn. We occasionally read in the newspapers of the "caving-in" of earth in this fashion, and its cause is due to the agencies I have mentioned.

In conclusion, I beg to thank you for your kindness in listening to what must necessarily be but an imperfect sketch of an interesting and important subject.

IV.

FURTHER NOTES ON COAST INSECTS FOUND AT BRANDON.

BY C. G. BARRETT.

Read 28th November, 1871.

It will be remembered that I brought forward last year some facts respecting the occurrence of certain species of coast insects on the "Breck" sand, (of which the district round Thetford and Brandon is composed) which facts seemed to me to lead strongly to the conclusion that these species had occupied this district from the time when it was a part of the then sea-coast. Besides recording the species which had come under my own observation, I mentioned certain other species—*Agrotis velligera* and *cursoria* among them—which have been found in this country exclusively attached to coast sands, and that it would be interesting to ascertain whether they were also to be found in the same district, In a subsequent

* Sir W. Jones informs me of the formation of several pits on his estate brought about in this manner.

note I mentioned that the former species had actually been found there.

There is another species, *Agrotis tritici*, which I did not mention because it occurs sparingly on inland heaths, but is only found in such situations of a dull brown colour, while on coast sandhills, where it swarms, it is generally distinctly and richly coloured and marked, and varies from whitish, with dark markings, to almost a jet black.

Having during the past season had further opportunities of investigating this subject, I venture to offer a few more facts bearing upon it, especially with reference to the three species just named.

In August last I had the pleasure of finding *Agrotis valligera* in the greatest profusion at Brandon, frequenting the flowers of *Scabiosa (Knautia) arvensis*, both by day and night, and with it an abundance of *Agrotis tritici*, of precisely the rich, deep style of colour and markings which characterize it on the coast, but although I worked long and hard, I was unable to find a single specimen of *Agrotis cursoria*.

Now, as this last species is the most plentiful of the three on the present coast of Norfolk, the fact of its total absence from the "Breck" sand, if, as I believe, this can be sustained, must be a convincing proof that the other species are not likely to have reached their present situation by emigration across the intervening land, from the present coast.

But the question naturally arises at once—Why should *Agrotis cursoria* be absent? Although so excessively abundant at Yarmouth, Caistor, Hunstanton, and probably on all the sandhills of the Norfolk and Suffolk coast, it is by no means so plentiful on those of the south and west of England, and in Ireland, as far as my observations have gone, far from common.

It seems, therefore, not unreasonable to suppose that it may be an immigrant from the eastward, at a comparatively recent date, and that it has attained its greatest abundance on the spot where it first obtained a footing. It would not, therefore, have been an inhabitant of this portion of the post-glacial sea-coast. On the other hand, most of the species already mentioned as found there, are quite as plentiful on the western coast as on our own, some of them more so—*Agrotis valligera* and *tritici*, and *Mamestra albicolaris*, for instance.

Of the species referred to last year, I have little further to say, except that their apparent abundance has been fully confirmed this season, and that I have had the pleasure of confirming Lord Walsingham's notice of the occurrence of the very local and elegant *Gelechia pictella*, which seems to be tolerably common in the Brandon district.

Two other southern coast species, *Aspilates citraria* and *Catoptria citrana*, also occurred there in August, in considerable numbers, and are interesting as collateral evidence, although I do not think that they are, either of them, quite so exclusively littoral in their habits as those previously noticed. Moreover, common as they both are in certain localities on the south coast, they appear to be either scarce, or extremely local on that of Norfolk.

V.

THE MARINE MOLLUSCA OF THE NORFOLK COAST,
(*ABSTRACT.*)

BY F. W. HARMER, F.G.S.

Read 28th November, 1871.

THERE is, perhaps, no portion of the natural history of our county which has received less attention than that which treats of the Marine Mollusca of our coast. The only list of them with which I am acquainted, is one given on the authority of the late Rev. G. Munford, of East Winch, in a small pamphlet on the Natural History of Hunstanton published in 1867, which however contains but about thirty species, and these principally distinguished by names which have now become obsolete. One of our hand-books on this subject, the "British Mollusca" of Messrs. Forbes and Hanley, gives but four shells from the Norfolk coast, two of which, *Arca lactea* and *Tellina donacina*, I have not yet met with; while the more recently published "British Conchology" of Mr. J. Gwyn Jeffreys alludes to but three, though both these works contain numerous localities for the species described in them.

The land and freshwater Mollusca have for some time past been assiduously worked by the Messrs. Bridgman, and Mr. Reeve, and the fact that the former gentlemen are about to publish in our "Transactions" the result of their work, induces me to supplement it by giving the names of ninety-one marine forms I have collected, for the information of any who may feel an interest in the subject. I do not offer the list as anything but a provisional one, but I shall be glad if it is the means of calling attention to a somewhat neglected branch of inquiry, and I shall feel exceedingly obliged if any, into whose hands it may come, who may be willing to co-operate with me in making it more complete, will kindly furnish me with any information bearing upon the subject.

I gladly acknowledge the courtesy of Mr. Gwyn Jeffreys, who has very kindly communicated to me the result of some dredging operations conducted, during last summer, by Capt. Calver, of H.M.S. "Porcupine," in Lynn Well, the deepest part of the Wash. The species found by him which I have not myself met with, are marked in the list with a "J."

I have also to thank Mr. J. B. Bridgman for allowing me to inspect his specimens, as also Mr. Reeve, of the Norwich Museum. Two shells given on Mr. Bridgman's authority are distinguished by having "B" against their names.

Mr. Munford, in the work before alluded to, mentions, in addition to the species given in my list, *Dentalium entalis*, *Chiton marginatus*, *Trochus magus*, and *Aporrhais pes-pellicani*.

There are also several other shells in our Museum, labelled "Norfolk Coast," but in Mr. Reeve's opinion, there is considerable doubt as to their authenticity.

It may, perhaps, be interesting to point out, that while sixteen out of the ninety-one species given below have a range exclusively to the north of our shores, those which range southwards only are almost entirely absent. During the earlier part of the crag period, we had living in what is now the Eastern Counties of England, a Mediterranean-like fauna, and again subsequently to the arctic conditions accompanying the formation of the contorted drift of the Cromer cliffs we had, as shewn by the sand and gravel beds of the middle glacial period, a Molluscan fauna whose aspect is preponderatingly southern, but as far as my list goes, the testacea now living here are, with one apparent

exception, all such as could have been introduced by currents from the north, and if this should be borne out by further investigation, it will be interesting, as confirming the belief which we have formed from geological reasons, that since the uprising of the land from the glacial sea, and the passing away of the glacial cold, there has never been that free communication between the German ocean and seas southward of this country which prevailed during the submergence of the glacial period. And, in connection with this, it may be further remarked, that in the *post-glacial* gravels of the Cambridgeshire fens, intermediate between the glacial period and our own, we find a Molluscan fauna somewhat more northern than that of our present seas, containing *Astarte borealis* and one other arctic shell.

I do not at present offer any further remarks, except to say that the coast from Wells to Hunstanton will best reward the collector, both as to abundance and diversity of specimens. The names given below are those adopted by Mr. Gwyn Jeffreys in his "British Conchology," the species which are most abundant on our shores being distinguished by an asterisk.

LAMELLIBRANCHIATA—(BIVALVES).

- Anomia ephippium, *Linn* :
- J " " var : aculeata.
- * Ostrea edulis, *Linn* : Oyster.
- * Pecten varius, *Linn* : Scallop.
- " opercularis, *Linn* :
- * Mytilus edulis, *Linn* : Mussel.
- * " modiolus, *Linn* : Horse Mussel.
- Modiolaria nigra, *Gray*.
- J " marmorata, *Forbes*.
- * Nucula nucleus, *Linn* :
- Leda minuta, *Müller*.
- Montacuta bidentata, *Montagu*.
- J Kellia suborbicularis, *Montagu*.
- Lucina borealis, *Linn* :
- Cardium exiguum, *Gmelin*.
- " fasciatum, *Montagu*.
- * " edule, *Linn* : Cockle.
- " Norvegicum, *Spengler*.

- Cyprina Islandica, *Linn* :
 Astarte triangularis, *Montagu*.
 Venus exoleta, *Linn* :
 ,, ovata, *Pennant*.
 ,, gallina, *Linn* :
 Tapes virgineus, *Linn* :
 * ,, pullastra, *Montagu*.
 * Tellina balthica, *Linn* :
 * ,, tennis, *Da Costa*.
 ,, fabula, *Grouovius*.
 J ,, pusilla, *Philippi*.
 J Psammobia tellinella, *Lamarck*.
 ,, vespertina, *Chemnitz*.
 Donax vittatus, *Da Costa*.
 * Mactra solida, *Linn* :
 ,, ,, var : elliptica.
 * ,, stultorum, *Linn* :
 * Scrobicularia alba, *Wood*.
 * ,, piperata, *Bellonius*.
 * Solen ensis, *Linn* :
 * ,, siliqua, *Linn* :
 ,, vagina, *Linn* :
 Corbula gibba, *Olivi*.
 * Mya arenarea, *Linn* :
 * ,, truncata, *Linn* :
 J ,, Binghami, *Turton*.
 * Saxicava rugosa, *Linn* :
 J ,, var : arctica.
 * Pholas candida, *Linn* :
 * ,, crispata, *Linn* :
 Teredo navalis, *Linn* :

Razor Shell.

Gaper Shell.

Shipworm.

GASTEROPODA—(UNIVALVES).

- Patella vulgata, *Linn* :
 Tectura virginea, *Müller*.
 B Trochus helicinus, *Fabricius*.
 J ,, tumidus, *Montagu*.
 * ,, cinerareus, *Linn* :
 * ,, zizyphinus, *Linn* :

Limpet. .

Top shell.

- * *Laeuna erassior*, *Montagu*.
 „ *divaricata*, *Fabricius*.
Littorina obtusata, *Linn* :
 „ *rudis*, *Maton*.
 * „ *litorea*, *Linn* : Periwinkle.
Rissoa parva, var : *interrupta*.
 J „ *striata*, *Adams*.
 J „ *semistriata*, *Montagu*.
 J „ *membranaea*, *Adams*.
 * *Hydrobia ulvæ*, *Pennant*.
Scalaria communis, *Lamarck*. Wentletrup.
 J *Odostomia rissoides*, *Hanley*.
 J „ *interstineta*, *Montagu*.
 J „ *spiralis*, *Montagu*.
 J *Eulima bilineata*, *Alder*.
Neritina fluviatilis, *Linn* :
 * *Natica eatena*, *Da Costa*.
 * „ *Alderi*, *Forbes*.
Velutina lævigata, *Pennant*.
 * *Purpura lapillus*, *Linn* :
 * *Buccinum undatum*, *Linn* : Whelk.
 * *Murex erinaceus*, *Linn* :
 J *Trophon truncatus*, *Ström*.
Fusus antiquus, *Linn* : Red Whelk.
 „ *græillis*, *Da Costa*.
 * *Nassa reticulata*, *Linn* :
 * „ *nitida*, *Jeffreys*.
 „ *inerassata*, *Ström*.
 * *Pleurotoma rufa*, *Montagu*.
 * „ *turricula*, *Montagu*.
 * *Cypræa Europæa*, *Montagu*. Nun Cowry.
Utriculus obtusus, *Montagu*.
 J „ *hyalinus*, *Turton*.
Melampus bidentatus, *Montagu*.
 „ *myosotis*, *Draparnaud*.

CEPHALOPODA.

- B *Loligo vulgaris*, *Lamarck*. Squid.

VI.

A LIST OF LAND AND FRESH WATER SHELLS
FOUND IN NORFOLK.

BY JOHN B. BRIDGMAN.

Read 30th January, 1872.

ALL the mollusca in the following list, with but two exceptions, have been found within a very short distance of the boundaries of the city of Norwich, and there is every probability that many others also might be found, if diligently sought for, in a more extended area. Hence it is very desirable that naturalists in other parts of the county should make themselves acquainted with the species in their own more immediate localities, as by these means we should have a more complete list, and obtain a better knowledge of the extent of their distribution; such assistance we have greatly felt the need of in compiling the following list.

Norwich and its neighbourhood are very rich in species, the number of marsh ditches to be found close to the city form a perfect paradise for the student of this branch of natural history. Yet this neighbourhood can scarcely be said to be more favourable in that respect than many other districts in the county, and as several of the species are extremely local, the contents of so small a field can hardly be deemed a fair average of the county, although a larger proportion has been obtained than might have been expected, for out of 121 British species (not counting varieties), described in the "British Conchology," published in 1862, by Mr. John Gwyn Jeffreys, (the arrangement and nomenclature of which has been followed,) we have already found in Norfolk 84—38 aquatic species out of 47, and 46 terrestrial out of 74.

It is in autumn, when vegetation has just passed its full growth, and shews signs of coming winter, that we see snails in the greatest profusion; every stream and pond swarms with the aquatic species;

hedge banks and clumps of nettles, after a heavy dew or mild rain, seem almost alive with various Limaces and Helices. The young are hatched, and are getting on with their growth, and others have arrived at maturity. It is supposed that Helices live about two years, and other genera may do the same. They are hatched in the summer, half grown by the winter, arrive at their full growth during the next summer, and die in their second hibernation. This I think probable, as the great majority of Helices one finds in the spring are young ones with no lip formed.

AQUATIC.

- SPHERIUM CORNEUM (Linné.) Abundant.
 ,, LACUSTRE (Müller.) Heigham. In the river.
 PIDIDIUM AMNICUM (Müller.) Common.
 ,, FONTINALE (Draparnaud.) var. Henslowana. Lynn.
 ,, PUSILLUM (Gmelin.) Thorpe ditches.
 ,, ROSEUM (Scholtz.) Heigham ditto.
 UNIO PICTORUM (Linné.) Abundant in almost every stream.
 ,, VAR COMPRESSA. This variety is found at sharp angles of the river, and may be caused by the swiftness of the current carrying away the loose particles of soil, and leaving a very hard bottom for the shell to live in.
 ANODONTA CYGNEA (Linné.) Common.
 ,, ANATINA (Linné.) Ditto.
 DREISSENA POLYMORPHA (Pallas.) Breydon.
 NERITINA FLUVIATILIS (Linné.) Heigham, on the leaves of water plants, posts, and roots of trees.
 PALUDINA CONTECTA (Millet.) Common in streams round Norwich.
 PALUDINA VIVIPARA (Linné.) Found with last-named species.
 BYTHINIA TENTACULATA (Linné.) Common everywhere.
 ,, LEACHII (Sheppard.) On water plants with above.
 VALVATA PISCINALIS (Müller.) Abundant. A thick yellow var. Lynn. Braekish water.
 VALVATA CRISTATA (Müller.) Common with Bitinia.
 PLANORBIS LINEATUS (Walker.) Plentiful in ditches at Thorpe and Heigham.

- PLANORBIS NITIDUS* (Müller.) Heigham.
 „ *NAUTILEUS* (Linné.) In a pond on Mousehold.
 „ *ALBUS* (Müller.) Sparingly on plants in the river.
 „ *GLABER* (Jeffreys.) In the river at Heigham.
 „ *SPIRORBIS* (Müller.) Common in almost every ditch.
 „ *VORTEX* (Linné.) Ditto.
 „ *CARINATUS* (Müller.) Ditto.
 „ *COMPLANATUS* (Linné.) Ditto.
 „ *CORNEUS* (Linné.) Ditto.
 „ *CONTORTUS* (Linné.) Ditto.
PHYSA FONTINALIS (Linné.) Abundant in most streams.
LIMNÆA GLUTINOSA (Müller.) At Heigham and Keswick, and is very periodical in its appearance.
LIMNÆA PEREGRINA (Müller.) Common everywhere.
 „ *AURICULARIA* (Linné.) River at Whitlingham.
 „ *STAGNALIS* (Linné.) Abundant.
 „ *PALUSTRIS* (Müller.) Common in marshes.
 „ *TRUNCATULA* (Müller.) In the river at Whitlingham.
ANCYLUS FLUVIATILIS (Müller.) On the Nuphar leaves, in the river at Heigham, and on other shells.
ANCYLUS LACUSTRIS (Linné.) Ditto, and stems of rushes.

TERRESTRIAL.

- ARION ATER* (Linné.) In damp, marshy places.
 „ *HORTENSIS* (Ferussac.) First in Whitlingham wood, now more generally dispersed.
LIMAX FLAVUS (Linné.) Under sinks and in out-buildings.
 „ *AGRESTIS* (Linné.) Too common.
 „ *ARBORUM* (Bonchard.) Catton, and Thorpe tollbar.
 „ *MAXIMUS* (Linné.) Not uncommon.
TESTACELLA HALIOTIDEA (Draparnand.) In a garden on the Ipswich road.
SUCCINEA PUTRIS (Linné.) Abundant on plants by the side of ditches, streams, &c.
SUCCINEA ELEGANS (Risso.) With above.
VITRINA PELLUCIDA (Miller.) In woods and damp hedge bottoms, under dead leaves.
ZONITES CELLARIUS (Müller.) Common.

- ZONITES ALLIARIUS (Miller.) Ditto.
 „ NITIDULUS. (Drap.) Ditto.
 „ PURUS (Alder.) Sandpit on Ipswich road.
 „ RADIATULUS (Alder.) Common in woods, at the roots of moss, and under leaves.
 ZONITES NITIDUS (Müller.) Banks of the river.
 „ CRYSTALLINUS (Müller.) Sandpit, Ipswich road, plentiful.
 „ FULVUS (Müller.) Common amongst dead leaves in woods.
 HELIX ACULEATA (Müller.) Sparingly, at the roots of moss, in Caistor and Arminghall woods, and at Thorpe.
 HELIX ASPERSA (Müller.) Common everywhere. A reversed specimen found at Thorpe in 1851.
 HELIX ASPERSA VAR EXALBIDA (Menke.)—A white variety, found at Thorpe and Catton.
 HELIX NEMORALIS (Linné.) Abundant.
 „ „ VAR HORTENSIS. Common in hedges and gardens.
 HELIX „ „ HYBRIDA. Catton.
 „ ARBUSTORUM (Linné.) Whitlingham, Postwick, and Bramerton, by the side of streams.
 HELIX ARBUSTORUM VAR FLAVESCENS. With last not uncommon.
 „ CANTIANA (Montagu.) On nettles by the road side, Ipswich road, Whitlingham lane.
 HELIX RUFESCENS (Pennant.) Abundant.
 „ HISPIDA (Linné.) Common in hedge bottoms.
 „ SERICEA (Müller.) Heigham osier grounds.
 „ VIRGATA (Da Costa.) Swaffham, Thorpe, Brundall.
 „ CAPERATA (Montagu.) Common.
 „ ERICETORUM (Müller.) Ditto.
 „ ROTUNDATA (Müller.) At roots of grasses and moss, Heigham osier ear.
 HELIX PYGMÆA (Drap.) Sandpit on Ipswich road.
 „ PULCHELLA (Müller.) Ditto.
 „ „ VAR COSTATA. Ditto.
 „ LAPICIDA (Linné.) On banks at Thorpe and Dunston.
 BULIMUS OBSCURUS (Müller.) Hedge bottoms. Common under dead leaves.
 BULIMUS GOODALLII (Miller.) In greenhouse of J. J. Colman, Esq.

PUPA UMBILICATA (Drap.) Not uncommon under dead leaves and at the roots of moss.

PUPA MARGINATA (Drap.) Ditto.

VERTIGO PYGMÆA (Drap.) Sandpit on the Ipswich road.

„ EDENTULA (Drap.) Thorpe, and near Mangreen Hall.

BALIA PERVERSA (Linné.) Fourteen specimens from a wall at Thorpe, beneath ivy.

CLAUSILIA RUGOSA (Drap.) Common.

„ LAMINATA (Montagu.) Whitlingham wood, abundantly on the trunks of elder trees, and several other woods sparingly.

COCHLICOPA LUBRICA (Müller.) Common at the roots of moss.

ACHATINA ACICULA (Müller.) At the roots of grass.

CARYCHIUM MINIMUM (Müller.) Abundant under dead leaves in woods.

CYCLOSTOMA ELEGANS (Müller.) Whitlingham.

ACME LINEATA (Drap.) Two specimens from Caistor wood.

VII.

ON THE SPONGEOUS ORIGIN OF FLINTS.

BY FREDERIC KITTON, V.P.

Read 27th February, 1872.

THE origin of the nodules of silica so frequently seen in the chalk has long puzzled the geological student as well as the casual observer, many besides myself have doubtless been told, that some of those nodules were petrified birds, (not stone curlews,) indeed the outline of some of them resemble the contour of a bird in no inconsiderable degree. The probable origin of Flint I shall have the pleasure of describing to you this evening, and in order to make the evidences of this origin stronger, I shall trespass on your time and patience whilst I give a short description of that class of organic forms known as Sponges.

Of all the protozoic forms the sponges are probably the only

organisms with which the ancients had any acquaintance, and the modern popular idea of a sponge is perhaps but little in advance of that possessed by the Greeks, who used to place it under their helmets and greaves to render the blows of the enemy less painful or dangerous, and for this purpose the finest kinds of sponge were used; no doubt the same species as now known as Smyrna Sponge, this species of sponge was called *Achilleum*.

The scientific history of the sponge commences with Aristotle, whose attention was probably called to this production from its amorphous shape, and the importance of its fisheries in the Mediterranean and Red Sea.

The name of Sponge is derived from *Σπογγος* or *σφογγος*, which is a form of *σφιγγω*, to squeeze; thus Homer in his *Illiad*, bk. xviii—

“Then with a sponge the sooty workman dressed,
His brawny arms embrowned and hairy breast.”

The description of the Sponge by Aristotle, with some exceptions, is tolerably exact. He says it is a “rooted animal, and seems to have some sensation, for they report, that it is torn away with difficulty, unless the attempt is made without warning.” In another place he says, “if the sponge perceives a person about to pull it off it contracts itself, and is difficult to be taken away, and it does the same if there is much wind or tide, in order that it may not be uprooted, but there are some persons who doubt this, as the inhabitants of Torone.”

Its generation is spontaneous in the hollows of the rocks, and like other things in the sea is nourished by the mud, of which they are full when taken up. And in the canals or apertures of the sponge are small crabs, which by opening and closing a sort of araneous net work over the apertures, do catch small fishes, opening it for their entrance, and closing it when they are gone in.

There are three sorts of sponges—one of loose, another of close or compact texture, and the third, is very fine and thick and very strong. The first is called *Manon*, loose, open, full of apertures; the second is called *Trage*, (in Greek *Tragos* means, or the good,) and the sponges are so named from their rough texture; and the third kind were called *Achilleum*, as before mentioned.

It thus appears that Aristotle was in favour of the animality of the sponges, but in other places he speaks more guardedly, and in

his detailed treatises, "de Partibus," "de Generatione," we shall see the conclusions to which his observations led him.

In his work on the Parts of Animals he denies that sponges possess sensation, and moreover asserts that they possess the character of a plant; his real notion of their nature was probably that of many later observers, namely, that they were intermediate organisms, partly vegetable and partly animal. Aristotle has remarked more than once, that "Nature passes continuously from things without life to animals, through things which live and are not animals, so that they appear to differ very little one from another when viewed in connection."

Pliny's knowledge of sponges is borrowed entirely from Aristotle, and he also claims an intermediate position for the sponges; he says, "that they have a third or middle nature, and are neither living creatures nor yet plants." He however seems to forget their "middle nature," and asserts that sponges have life, yea, and a sensible life, for there is found of their blood settled within them; and he quotes some writers who report, that they have the sense of hearing, which directs them to draw in their bodies at any sound or noise that is made, and therewith to squeeze out plenty of water contained within. Pliny again quoting some writers, says, "that sponges may be distinguished into male and female." Although the early observers of sponges were inclined to believe in their animality, later writers were generally inclined to place them in the vegetable kingdom, and considered them to be imperfect productions, and as they were without seed, they attributed their generation to a fermentation of the sea's scum, or its spontaneous pallubating. There is found says Gerarde, in his Herbal, 1633, "growing upon the rockes neare vnto the sea, a certain matter wrought together of the fome or froth of the sea, which we call sponges." The animality of sponges was not, however, allowed to sink into oblivion, for every editor or annotator of Aristotle or Pliny reproduced their opinions of the animality of the sponges, but no observer possessed sufficient courage to remove them from the vegetable kingdom. Ferranti Imperato in his *Historia Naturale*, 1672, although he had suspicions of their animal nature, describes the sponges among cryptogamous vegetables, and expresses an opinion, that in their structure they were closely allied to the Fungi.

Ray rejects the notion of life and sensation in sponges, and agrees with Imperato in their relationship to the Fungi. (Ray's *Historia Plantarum*, 1686.)

Linnaeus in 1760 arranged the sponges amongst the cryptogamous Algæ.

The sponges were thus bandied about between the animal and vegetable kingdoms, until Ellis advocated their animal nature, and Linnaeus by his advice in the twelfth edition of the *Sytema*, arranged them amongst the animal zoophytes. From this time the animality of sponges was universally assumed, and their functions generally admitted, not, however, without opposition, the most celebrated of those who opposed this theory was Spellanzi.

I must not, however, trespass further on your time and patience, with the pro and cons of the early naturalists. The animal nature of sponges has now been definitely settled, and their true position in the animal kingdom fixed. Montague, in 1818, says, "The true character of Sponges is that of a living inactive gelatinous flesh, supported by innumerable cartilaginous or corneous fibres or spicula, most commonly ramified or reticulated, and furnished more or less with external pores or small mouths."

Ray describes two species of Fresh Water Sponge, as having been found in the river Yare, near Norwich, by Newton.

I have found the same forms *Spongilla fluviatilis* and *Spulchella* in the same habitat.

Various species of Sponge have from time to time been described by different observers, but no systematic work appeared until the publication of the *British Sponges*, by Dr. Johnson, in 1842. A work remarkable for its research, and the accuracy of the Author's observations.

The following is his character of these organisms:—

CLASS AMORPHOZOA.

CHARACTER.—Organized bodies growing in a variety of forms, permanently rooted, unmoving, and unirritable, fleshy fibre, reticular, or irregularly cellular, elastic, and bibular, composed of a fibro corneous axis, or skeleton, often interwoven with silicious or calcareous spicula, and containing an organic gelatine in the interstices and interior canals, reproduction by gelatinous granules generated in the interior, but in no special organ.

All are aquatic, and with few exceptions marine.

He describes seven genera of Sponges, all of which are, with one exception, marine ; and all, with one exception, contain either calcareous or silicious spicula.

The literature of the Sponges after this consisted to a great extent of desultory papers, appearing from time to time in various Scientific Journals, but, no attempt was made to continue the work begun by Johnson, until the Ray Society published Dr. Bowerbank's valuable monograph on the British Spongiadae ; in this monograph the Author has to some extent ignored form as a genera, or even specific character, and has adopted the microscopic structure as shown in the form and arrangement of the spicula.

The position of the sponges seems to be midway between the amœbæ and the foraminifera, the former consisting entirely of sarcodæ, and without any kind of spicula or external shell ; and the latter possessing a shell composed of one or more chambers ; the sponges although destitute of an external shell possess a keratose skeleton, strengthened in the majority of cases by calcareous or silicious spicula.

The vital and therefore the most important part of the sponge is the sarcodæ, and with your permission I shall endeavour to give as lucid a description as possible of the important part performed by this material, and perhaps the best idea of it can be obtained by soaking a piece of isinglass in water, the living sarcodæ, like the softened gelatine, is semi-pellucid, varying in colour from external causes, and during life insoluble in water.

The absence of special organs in the Amœbæ Sponges, &c., clearly indicates that the power of assimilating nutriment is possessed by this material, and identifies it with the sarcodous system, covering the digestive surfaces of animals ; we can trace the presence of this wondrous matter from the highly developed mammal to the humble amœba, other organs may become obsolete, and at last we find that sarcodæ alone remains. And this apparently inert, shapeless, structureless mass of jelly is endowed with the power of producing those elegant forms known as polycystina and foraminifera, or as in the case with the sponges, the multitudinous varieties of spicula, (Bowerbank figures and describes between two and three hundred distinct forms of spicula, and does not then describe all the forms,) and even build up with silex abstracted

from the waters a silicious skeleton of surpassing beauty, as seen in the *Euplectella* and *Dactylocalyx*, or elaborates long bundles of silicious fibres, as in *Hyalonema* and *Pharonema*.

Another substance found in sponges, and that with which we are best acquainted, is keratode, or horny fibre, this like the silicious framework just alluded to, is invested with sarcode; in some genera, (as in the sponges used for domestic purposes,) no spicules are formed, in others the spicules predominate.

As we find among the Foraminifera certain forms which do not secrete a shell, but form one by glueing together minute grains of sand, so may we also detect certain species of sponge in which the skeleton has neither silica or solid keratose, but is composed of grains of sand enclosed in a thin keratose covering.

I am much afraid that I have already occupied so much of your time with what is after all a very meagre outline of the structure of these remarkable organisms, that what should be the principal subject of the paper must be treated very briefly. I must, however, in as few words as possible call your attention to the protoplasm found in layers on the ooze at the bottom of the sea; those of us who attended the Biological Section of the British Association in 1868, will remember an interesting paper by Professor Huxley on Bathybius, in which he described this sarcodous layer, and the remarkable forms occurring in it, known as coccoliths and coccospheres; these forms may be found in chalk, clearly indicating that the bottom of the sea, during the cretaceous period, was also covered in places with protoplasm. I must ask you to bear this fact in mind, as I think we shall find that it has an important bearing on the theory of the Spongy Origin of Chalk Flints.

If a thin chip or section of Flint is submitted to microscopic examination, sponge spicules in more or less abundance, will invariably be seen, mixed with these will be found casts of the interior of the chambers of Foraminifera, fragments of Polyzoa, and small molluscous shells.

When a recent sponge is examined, similar organisms will be seen entangled in the reticulated skeleton. A cretaceous flint, like silica obtained by dialysis is non-crystalline, breaks with a distinct conchoidal fracture, is singly refractive, and therefore is not affected by a polarized beam of light, in this respect resembling silica taken up by undoubted animal or vegetable organisms. I may,

perhaps, be reminded that the cuticle of the Dutch rush and the stellate hairs of *Deutzia*, both of which are silicious, do polarize, and exhibit brilliant colour when examined by light in that condition, but this is not in consequence of their silicious nature, but is due to the presence of a membraneous film investing the cuticle or hair. If a piece of *Equisetum* or *Deutzia* is boiled in sulphuric acid, and then decarbonized with chlorate of potash, a display of colour will no longer be visible. The shells of the polycystina, sponges, spicules, and the Diatomaceæ are all singly refractive.

The base of silica is Silicon. Silica under certain conditions is soluble in water to a considerable extent. Waters holding silica in solution, that is to say, in any large quantity of it, are now extremely rare; the Geyser and Rykum in Iceland, and the Pennakoon and Loongootha in India are the best known. An analysis of a gallon of the Geyser water showed 31.50 of silica. It is highly probable that silica was present in larger quantities in the earlier epochs of the world. This, however, is not a question of much importance, as we know that it exists in a soluble form, and is eliminated, often in great abundance, by various organisms. I need only refer you to the *Aleyoncellum*, *Hyalonema*, *Pharonema*, and other Silicious Sponges as evidences of that fact.

The presence of silica in a state of solution being an ascertained fact, there is nothing improbable in the hypothesis, that sponges should have formed the nuclei of these flinty concretions, the silicious spicules would possibly exert an attractive influence upon the atoms of silica in solution, in a similar way that a crystal of saltpetre would be the starting point for further crystallization in a solution of that salt.

Another and still more effectual cause of the elimination of silica would be the decomposition of the sarcode and keratode material, as this goes on certain gases are produced, and the silex precipitated from a solution.

The discoveries of Wallich, Carpenter, and others, of protoplasm or sarcode existing at the bottom of the ocean, and to which I have previously alluded, appear to afford a probable explanation of the cause of solution to the flinty layers found in some of the chalk strata. The opponents to the spongy origin of flints brought forward the the existence of these layers as a proof that sponges were not the nuclei of Flints, and until the existence of

this free sarcode was detected, the occurrence of Flints in some localities in the form of nodules, and in others as layers, was difficult to account for, but when it was found that sarcode existed in masses covering a considerable area, a clue to the formation of the flint layers became apparent. Carbonic acid gas, and hydrogen were liberated when decomposition set in, and silex replaced the sarcode. That Flints are now forming, is, I think, as certain as the formation of new beds of chalk, and it is an ascertained fact, that the valleys in the bed of the ocean, are, as in days of yore, being gradually filled with calcareous matter intermingled with remains of sponges, or permeated with protoplasm, these as decomposition slowly takes place are separating the silica from the surrounding waters.

It will, I think, be allowed, that flint nodules could not have been found in chalk unless a nucleus had existed, the silica contained in the water was chemically combined with it, the chalk only mechanically, and if any silica was parted with it would only act as silicious cement hardening the atoms of chalk.

The probability that Flints are still in the process of formation, is confirmed by the frequent discovery of silicious casts of foraminifera, those usually found are composed of silex with traces of iron, giving them an olive green colour, precisely like those found in the green sand.

In a dredging made at Porto Seguro by Capt. Perry, of Liverpool, I found many shells of foraminifera, which when acted upon by acid, showed the interior filled with a silicious cast of the internal chambers, and in some specimens even the pseudo-podal apertures had also been filled with silex, fragments of other silicified organisms were also of frequent occurrence. The casts found in this dredging differed from those usually found by the absence of any trace of iron, and appeared to be silica in a similar condition to the ordinary chalk Flint.

In the green sand large silicious nodules, known as Polypothecia are of frequent occurrence, and when thin sections are examined their spongy origin is distinctly seen; these nodules were, however, formed under somewhat different conditions to the ordinary chalk Flint, the silica is distinctly crystalline and doubly refractive, and polarizes like quartz or agate; the sponges were also probably different from those belonging to the chalk; a careful

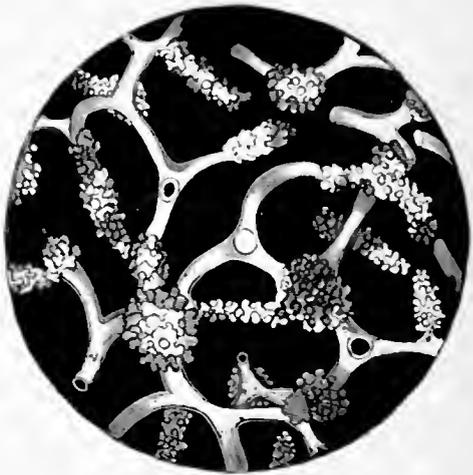
microscopic examination of very many sections did not reveal the presence of any form of spiculum, they were most likely allied to the recent keratode sponges, in fact, a thin slice of ordinary domestic sponge greatly resembles a section of his silicified predecessor. The reticulations are not solid but tubular, and I have been able, in many cases, to fill them with colouring matter.

The following figures are from camera lucida drawings of sections of *Polypothechia*, No. 1, from the green sand, Warminster; No. 2, from a fragment obtained from Mr. Colman's artesian well, at Carrow, Norwich.



1.

Polypothechia \times 150 diameters,
green sand, Warminster, Wilts.



2.

Polypothechia \times 150 diameters,
green sand, Carrow, Norwich.

The following extract from a paper on the process of Silicification of Animals, read before the Geological Association last June, by Mr. H. M. Johnson, F.G.S., may perhaps be of interest. The author points out "how a crop of sponges invested with their gelatinous flesh or sarcode, and living at the bottom of a deep ocean, were suddenly buried in a thick stratum of white mud consisting of the minute shells of foraminifera, that they then died, and that while in the process of decomposition this interchange of materials took place; the nascent carbonic acid parting with its carbon in exchange for the silica of the silicate of soda which sea water is known to contain."

To illustrate the power possessed by decomposing organic matter

he produced two tadpoles, or rather one and the remains of a second. The first had been placed in a solution of silica, and after the lapse of a few hours was submitted to the action of nitric acid, without any apparent injury; the other which had not been submitted to the silicifying process before being placed in the nitric acid, was instantly destroyed, the only trace of it being a little brown eloud floating in the acid.

The discoveries made in the dredging expeditions of the Porcupine and Norma have given an impetus to the study of the sponge forms, and although we may not have the opportunity of adding new genera or species, all of us who possess a microscope can study the life history of the common fresh water sponge, *Spongilla fluviatilis*, it may be found in almost every pond or small stream, and a few hours study of a fragment of a living sponge will give the observer a better idea of that marvellous substance we call sarcode or protoplasm, than any lecture or paper can ever hope to do, he will see life reduced to its simplest conditions, and if he carry his observations to forms slightly more complex he will be able to form some conception how all forms of life are linked together, forming one harmonious whole, or to quote the words of Goethe :—

“ Wie alles sich zum Ganzern webt,
Eins in dem andern wirkt und lebt.”

Some may be inclined to say, there is surely nothing pleasing to the eye, or pleasant to the touch in these slimy things, this apparent unpleasantness will soon be lost sight of, when once the mind is interested.

In concluding this very imperfect description I cannot do better than remind you of the words of the great Stagirite. “For that nothing is by chance, but for some end is the character of all the works of nature; and the fitness of each part to the end for which it is designed occupies the place of, and is entitled to the name of Beauty.”

VIII.

MISCELLANEOUS NOTES AND OBSERVATIONS.

ORNITHOLOGY.

ABUNDANCE OF QUAILS IN NORFOLK, IN THE YEAR 1870. In a note on this subject in last year's "Transactions," I deferred expressing any opinion as to the cause of such an extraordinary number of quails remaining to breed in this county, but their scarcity during the present season (1871), very few nests or birds having been met with, renders it, I think, pretty certain that the marked increase in their numbers in the spring of 1870 was owing to a very exceptional immigration of this species. These birds, from whatever direction they may have reached the shores of Great Britain, located themselves most numerously in Pembrokeshire on the west, and Norfolk on the eastern coast. The numbers met with in that part of Wales, however, far exceeded anything observed in this county. Taking these two points as the head centres of one enormous flight, the records at the time in the *Zoologist* and other Natural History Journals seem to indicate that they were also sparsely scattered in other English counties, from Sussex to the North of Yorkshire, and throughout various parts of Scotland. *H. Stevenson.*

ORTOLAN BUNTINGS AT YARMOUTH.—Mr. Stevenson has given his reasons in the "Birds of Norfolk," (vol. i, p. 199,) for excluding the ortolan bunting; but from what has recently come to light it would seem that it may yet be entitled to a place in the rich avi-fauna of our county. Last year I bought a specimen of Mr. Gunn, (a dull-coloured one compared with the plate in Sharpe and Dresser's "Birds of Europe,") which had been netted at Yarmouth in April, 1866, and kept alive two days by a man named

Harvey. More recently Mr. Davy, a bird-dealer in Camden Town, who generally has a catcher at Yarmouth, had sent him from that place six, two of which are alive in my brother's possession, and are recorded in the "Zoologist," p. 2682. They were taken on the 5th of May, 1871, and the name of the man who took them was Seale. They may have escaped from confinement, but I think it very probable that they were really wild birds.

J. H. Gurney, jun.

CALAMODUS AQUATICUS, LATHAM.—I cannot help thinking that the aquatic warbler (*Calamodus aquaticus*) often occurs in this country. I recently detected one in a provincial museum, which, like the only other two specimens on record, had been passed over as a sedge warbler. There cannot be a doubt that the figure in Hunt's "British Birds," was taken from one, in all probability obtained in Norfolk, but there is no letterpress to accompany it.

It is only necessary to remember that in the aquatic warbler, there is a narrow stripe of yellowish white down the middle of the crown of the head, the unfailing mark of distinction between this species and its congener, as may be seen in a specimen in the Norwich Museum, which I shot in Algeria, where I found both of them freely associating. *J. H. Gurney, jun.*

MORTALITY AMONGST SWALLOWS AND MARTINS.—In the first number of our "Transactions," under the above title, will be found a record of the mortality which occurred in 1869, amongst the swallow tribe, from the extremely low temperature experienced in that year, between the 24th and 29th of May. Hundreds of these birds perished at that time, throughout the county, from the combined effects of cold and hunger, the absence of sun by day depriving them of insect food, and the cold of the nights and early mornings having a fatal influence in their starved condition. The same consequences, though not to the same extent, have resulted from the unseasonable weather of the last few weeks, [Read July, 1871], the prevalence, even up to the end of June, of north and north-east winds having had an unhealthy influence upon the feathered tribes, as well as on ourselves.

Mr. Ringer, of West Harling, in whose exposed neighbourhood, in 1869, the swallows and martins suffered most severely, informs

me that, during the extreme cold which prevailed for a week or two prior to the 10th of June, many of these birds were found dead upon his farm, but not in the same numbers as on the former occasion, as but few had returned to their old haunts since that date. His men, when going to work early in the morning, have seen them clustered together on the sheltered sides of the fences, too exhausted to move far when disturbed, but these, if the sun shone out later in the day, would revive with the warmth and fly feebly over the pastures after the little insect-life then stirring.

No doubt the same thing has been observed elsewhere, more or less, according to the open or enclosed nature of the locality; for, even as late as the 22nd of June, when driving from Norwich to Surlingham, (a cold north wind blowing at the time), I saw two swallows on the road, scarcely able to flutter above the ground. That the same cause and effect have been experienced on the Continent is shown by the following extract from a letter of the Paris Correspondent of the *Daily News*, for June 12th, wherein the writer, diverted for once from war topics and Communism, remarks: "For several days past large numbers of dead martins (a species of swallow) have been found in the public streets." *H. Stevenson.*

SNOWY OWL AT SOUTHREPPS.—On the 4th of December a noble snowy owl was shot in a turnip field at Southrepps, near Cromer, by a farmer named Painter, who has presented it to Sir T. F. Buxton.

I found it to be a female, and from the numerous broad bands of deep black on a white ground, I judged it to be immature. These bands have since rather faded. This rare species has occurred on several occasions in this county, though not within the last twenty years; it is worthy of remark, however, that out of seven examples previously recorded, four were obtained in close vicinity to the sea, and within a few miles of the spot where this last one was killed. *J. H. Gurney, jun.*

BIRDS ATTRACTED TO CROMER LIGHTHOUSE.—About the 20th or 27th of October, between one and two a.m., as one of the Cromer lighthouse keepers sat in his lantern, he heard two birds strike the glass, and going out he found them fluttering there and

caught them. They proved to be starlings; and from that time a continual stream of these birds and larks (the latter preponderating) kept coming until five a.m., clustering wherever the light was strongest, and allowing themselves to be caught by handfuls. There was little wind, but what little there was was from the north, from which direction they seemed to come. Before the dawn broke he had caught a hundred, and when he went down he found six (four starlings and two larks) on the ground outside the lighthouse. No other birds were observed with the exception of an owl, but there were great numbers of moths. He heard a starling shriek, and presently the owl came flying round and bore off one close to his head. I saw some of the moths which resembled Gamma moths, but were smaller and darker. *J. H. Gurney, jun.*

ON THE OCCURRENCE OF WHITE-WINGED BLACK TERNS (*Sterna leucoptera*) IN NORFOLK.—On the 26th of May, 1871, a flock of five white-winged black terns were observed settling on the “muds” of Breydon, near Yarmouth, of which four were killed at one shot. The odd bird did not come within range, and was not seen again, but two had been remarked on the same water a day or so before. Of the four specimens thus procured two proved to be males and two females, in full summer plumage. So rarely has this tern occurred in this country that Yarrell records but one example, an adult male, shot amongst some common black terns, on the Shannon, in 1841; it has, however, in two other instances, since that date, been killed in this county, one on Horsey Mere, May 17th, 1853, and one on Hieking Broad, June 27th, 1867, both adult birds. *H. Stevenson.*

FRENCH PARTRIDGE LAYING IN A TEAL'S NEST.—The following curious circumstance was remarked in the summer of 1871, by a gentleman, who, as a sportsman, is well acquainted with both species. Having flushed a teal from her nest among the marram-grass on the the sand hills at Dunwich, Suffolk, he found, to his surprise, that it contained not only four or five teal's eggs, but as many of the french partridge. *H. Stevenson.*

ROSE-COLOURED PASTOR AND PURPLE HERON.—Amongst the rarer birds obtained in this county during the past year may be recorded an adult male rose-coloured pastor, killed at Reedham, near Yarmouth, on the 17th of August, and a young purple heron, now in the collection of Mr. J. H. Gurney, jun., killed at Horning, on the 4th of December. *H. Stevenson.*

LAPLAND BUNTING AT CLEY-NEXT-THE-SEA, IN NORFOLK.—On the 18th of December, Mr. H. Pashley, bird-stuffer, informed me that he had a bird with an elongated hind-claw, which answered to the description of the Lark-heeled Bunting. Shortly after it passed into the possession of Mr. H. M. Upcher, who sent it to Mr. Baker, a bird-stuffer at Cambridge, where it came under the observation of Professor Newton and Mr. Tuck.

I am informed that there is no doubt about the species, and that it is a male in immature or winter plumage, like almost all the others which have occurred in this country.

Respecting the capture of this bird Mr. Pashley writes—"I shot it in the last week of October, about five or six hundred yards from the beach; it was quite alone. There was something about it that attracted my notice, or I should not have thrown a charge from a large flight-gun at it of No. 1 shot."

Notices of the two previous occurrences of this species in Norfolk will be found at pages 4631 and 8032 of the "Zoologist," and at page 181 of the first vol. of the "Birds of Norfolk."

J. H. Gurney, jun.

OCCURRENCE OF WHITE'S THRUSH (*Oreocincla whitei*, GOULD) FOR THE FIRST TIME IN NORFOLK.—A very beautiful example of this fine Asiatic species, which till very recently was considered one of the rarest birds in the British list, was killed by Mr. F. Borrett, on the 10th of October, 1871, in a low meadow at Hickling, and by permission of its present possessor, the Rev. S. Mickleton, was exhibited at the November meeting of this Society, by Mr. J. H. Gurney, jun., who made some remarks upon the genus *Oreocincla* as distinguished from that of *Turdus*. This bird, as it rose some thirty yards off, was mistaken by Mr. Borrett for a woodcock, from its large size and peculiarity of flight; a resemblance

noted in several other instances in which this thrush has occurred in this country. A detailed description of its plumage, by Mr. T. E. Gunn, with measurements, taken before it was preserved, will be found in the *Zoologist* for 1871, (p. 2848). In colour and general appearance this specimen resembles very closely the figure given by Gould, in his "Birds of Great Britain." *H. Stevenson.*

OCURRENCE OF "PAGET'S" POCHARD IN NORFOLK.—During the early and severe frost that occurred at the beginning of November, 1871, a specimen of this wild hybrid between the white-eyed pochard (*Fuligula nigroca*) and the common pochard (*F. ferina*) was killed amongst a number of "eripples" on Hickling Broad, on the 13th of that month, and two similar birds are said to have been seen at the same time. This specimen proved to be a male, on dissection, as were two previous examples killed in this county—an immature male at Rollesby on the 27th of February, 1845, and an adult male at Little Waxham on the 24th of February, 1859. For a notice of the two previous Norfolk specimens, of two purchased some years ago in the London market and of a pair taken near Rotterdam in April, 1850, see the "*Zoologist*" for 1859 (p. 6536). *H. Stevenson.*

WATER-SPOUT IN THE MEDITERRANEAN.—STEAM SHIP "IBERIAN" AT SEA, *June 10th, 1871.*—Since leaving Gibraltar we have had incessant rains, and have been running before a fair gale at the rate of thirteen knots an hour. Passed Malta this morning and hope to reach Alexandria on Saturday morning. Our gale is varied by a heavy fall of hail and rain, to diversify its agreeableness. Yesterday, 10 a.m., off the coast of Tunis; a fresh N.W. gale, fair, a little on one side; observed a waterspout driving down across our course, and it was doubtful which would get to the meeting point first. We were going thirteen knots, but you never lose by *politeness*, so I stopped the engines and gave precedence to the queer looking stranger. It passed across our course

about three ships' lengths ahead of us, (at least 900 feet), and was a fine sight; the heavy cloud attracting the water up the slender tube with its taper point connected with the whirl of water below, and which had risen to about fifty feet high and gyrating in the sun, throwing off a large quantity of spray by the rapidity of the gyrations, and it was sufficiently near to observe the vortex in the centre and the cloud blowing away ahead of the water. The tube had a large incline, and appeared, as you might imagine, to be towing the reluctant water from its bed. It was a pretty sight, and would have made a good picture. "The Iberian waiting to allow a waterspout to pass"—in deference to its humidity. It was perfectly transparent, and the tube like a round tapering column of water, or rather, a stream, and the spiral water was outside that again, encircling the tube. We stopped ten minutes to let it cross us. I have heard that they are dangerous to encounter, but I did not wish to try; it did not look so pleasant as picturesque. I had never been so near one before. Sometimes the tube took a snake-like form, sometimes only an inclined form, according to the rise and fall of the cloud, I suppose, and its velocity.—*In a letter from Matthew Fitt, Captain S.S. "Iberian," Liverpool to Alexandria.*

NORFOLK & NORWICH NATURALISTS' SOCIETY.

RULES.

1. That this Society be called "THE NORFOLK AND NORWICH NATURALISTS' SOCIETY," and have for its object the practical study of Natural History in all its branches.

2. That the Officers of the Society be a President, Vice-Presidents, Treasurer, Secretary, Auditor, and Local Secretaries in such places as may be thought desirable, all to be elected yearly at the Annual Meeting. Each retiring President to be added to the list of Vice-Presidents.

3. That the General Committee consist of the Officers of the Society, together with nine Members (who shall, at their First Meeting, elect one of their number Chairman for the ensuing year,) three of such Members to retire annually in succession, their successors to be appointed at the Annual Meeting; such retiring Members not being eligible for re-election for one year. Any vacancy occurring in the Committee after the Annual Meeting to be filled up by themselves, and any Member so elected shall continue in office for the same period as the Member would have done in whose place he is elected. The Committee to meet monthly at such time as shall be found to be generally convenient. Three to form a quorum.

4. That a Meeting be held in the Museum at half-past seven in the evening of the last Tuesday in every month, for the purpose of reading papers on, and discussing subjects connected with Natural History; and that the Members be invited to form collections of specimens of the natural productions of the district.

5. That the Annual Meeting for the election of Officers for the ensuing year, the receiving of the Treasurer's report, and the transaction of such other business as may be brought before it, shall be held on the last Tuesday in March ; and that at such Annual Meeting the President of the preceding year shall deliver a short address, containing a summary of the proceedings during the past year, together with such observations from himself as he may deem conducive to the welfare of the Society and the promotion of its objects.

6. That the Members shall hold Field Meetings in interesting localities for the purpose of studying the Natural History of the district. That the place of meeting be fixed by the General Committee, and timely notice be given to each Member, who must, within four days of the Excursion, inform the Secretary of the number of tickets he requires. In case of unfavourable weather at the time of an excursion, the Members present at the place of starting shall decide whether to proceed with or postpone the Excursion.

7. That minutes of the Meetings and proceedings and a List of Members be kept by the Secretary, who shall at the Annual Meeting make a report of the number of Members.

8. That all Candidates for Membership shall be proposed and seconded by existing Members at any meeting of the Society, and shall be elected by a majority of the Members present. Members elected after the December Meeting shall not be liable for the Subscription for the financial year in which they are elected, and shall be entitled to purchase the Society's Publications for that year at the price at which additional copies are issued to Members.

9. That a class of Honorary Members be admissible, consisting of ladies and gentlemen distinguished for their attainments in the study of Natural History, or who have rendered valuable services to the Society. That such Honorary Members be nominated by the General Committee, elected by a majority at any meeting, and have all the privileges of ordinary Members.

10. That every Member shall be furnished with a Card on which is printed the dates upon which the Meetings during the ensuing year are fixed to be held. A special notice of each Meet-

ing will be sent to any Member paying annually, in addition to his Subscription, One Shilling, or such sum as the Committee may consider sufficient to defray the cost of such notice.

11. That the Subscription be Five Shillings per annum, payable in advance, and that all Subscriptions become due on the day of the Annual Meeting.

12. That each Member may introduce two friends at any Meeting, except the Annual Meeting, or at any Excursion of the Society, but that the same persons shall not be admissible more than twice during any one year.

13. That a Committee be appointed, to be called the Journal Committee, to consist of Five Members, who shall be elected annually at the General Meeting; the Officers for the current year to be ex-officio Members. Such Committee to select from the papers read before the Society any which they may think of sufficient interest and importance to be published, and also to give advice and directions to Members desirous of collecting specimens. The Members of such Committee not to be ex-officio Members of the General Committee.

14. That the papers selected by the Journal Committee shall, with the consent of their respective authors, be published, from time to time in a cheap octavo form, under the title of "The Transactions of the Norfolk and Norwich Naturalists' Society," and distributed gratuitously to all Members whose Subscriptions are not in arrear, and that such Journal may be sold to the public at a price to be fixed by the Journal Committee.

15. That all elections of Officers shall be by ballot.

16. That the General Committee shall have power to enact such bye-laws as they may deem necessary, which bye-laws shall have the full force of laws until the ensuing Annual Meeting; and that notice of such bye-laws be communicated to the Members at such ensuing Annual Meeting.





TRANSACTIONS

OF THE

Norfolk & Norwich

NATURALISTS' SOCIETY;

PRESENTED TO THE MEMBERS FOR

1872—73.

NORWICH:
PRINTED BY FLETCHER AND SON.
1873.



Copies of the TRANSACTIONS OF THE NORFOLK AND NORWICH NATURALISTS' SOCIETY can be obtained of the Assistant Secretary, Mr. J. Quinton, jun., at the Norfolk and Norwich Literary Institution, St. Andrew's Street, Norwich; or of the Publishers, Messrs. Fletcher & Son, Market Place, Norwich, at the following prices:—

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Norfolk & Norwich Naturalists' Society.

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The Treasurer in Account with the Norfolk and Norwich Naturalists' Society,
year ending 25th March, 1873.

Dr.

Cr.

	£	s.	d.
By Balance from last year	...	...	14 2 6
Subscriptions:—			
3 for 1871—2	£ 0	15	0
106 „ 1872—3	26	10	0
Additional payment for monthly notice of Meeting	27	5	0
Sale of <i>Transactions</i>	0	9	0
Sale of wood-blocks illustrating Mr. Kitton's paper	1	4	6
Interest:—	0	10	0
P. O. Savings Bank	£0	4	0
Gurneys and Co.	0	13	5
			0 17 5
			£44 8 5
Printing <i>Transactions</i> for 1871—2	...	...	13 5 0
Illustrating ditto	...	...	1 0 0
Stevenson—Printing	...	...	1 12 8
Fletcher—ditto	...	...	0 10 0
Postage and Stationery	...	...	1 19 0
Annual Subscription to Museum	...	...	2 2 0
Assistant Secretary's Salary	...	...	4 0 0
Balance in hand	...	...	19 19 9

Examined and found correct,

T. G. BAYFIELD,
Auditor.

MARCH 21ST, 1873.

ADDRESS

Read by the President, MICHAEL BEVERLEY, M.D., to the Members of the Norfolk and Norwich Naturalists' Society at their Fourth Annual Meeting, held at the Norfolk and Norwich Museum, March 25th, 1873.

GENTLEMEN—In presenting to the members of the Norfolk and Norwich Naturalists' Society a retrospect of the proceedings during the fourth year of its existence, I will not attempt to occupy time in urging apologies for my deficiencies and short-comings, of which no one is more conscious than myself, but at once proceed to give you a short resumé of the various papers and communications which have been brought before the Society during my year of office; trusting that the same considerate kindness which led you to appoint me (much against my wishes) your President in the year which is past, will be extended to this the termination of my duties.

In reviewing the year's transactions, I find that the only branches of Natural Science, with one or two exceptions, which have occupied our attention have been *Ornithology*, *Entomology*, and *Botany*, and in this order I will endeavour to group the following brief observations.

Ornithology. An extremely interesting and valuable paper on the *Ornithology of Spain* was contributed at the August meeting by Mr. Howard Saunders. Mr. Saunders pointed out that what is known of the birds of Spain, is due rather to the labours of German than English ornithologists; according to him Gibraltar has been of more service to the diplomatist than the naturalist, thanks however to the labours of Mr. Saunders, together with Lord Lilford and Major Irby, our country is not altogether unrepresented in Spanish ornithology; and the Society ought to

feel much gratified at being the recipient of so interesting a paper from so distinguished an ornithologist.

Our late President, Mr. Henry Stevenson, read at the October meeting some valuable notes on the *Rare occurrence of, and additions to, the Birds of Norfolk*, during the past year; among which he enumerated the snowy owl, (a hitherto unrecorded specimen), dipper, black redstart, grey-headed yellow wagtail, and alpine swift, Mr. Stevenson also mentioned that an American white-winged crossbill, identified and purchased by Mr. John Henry Gurney, jun., had been captured in the rigging of a ship off Yarmouth in 1870, and was now in his (Mr. Stevenson's) aviary, "a tame and interesting pet." In this paper the increased number of woodcocks nesting in Norfolk was alluded to; information regarding the occurrence of which, during the present season, had been previously given to the Society by Lord Kimberley, Mr. Purdy, and Mr. J. H. Gurney, jun., the latter of whom expressed his belief that this bird if left undisturbed, showed an increased disposition to remain and breed in this county.

At the May meeting Mr. J. H. Gurney, jun., exhibited several spring migrants which had been killed by flying against the Cromer lighthouse, and expressed his opinion that the species of birds which met with this untimely end were always migrants or partial migrants.

The Society heard with regret from the Rev. H. T. Frere, of Burston, that a large quantity of hawfinches had been killed at Diss; and, as the Protection Act gave to these birds no legal shelter during the winter months, steps were taken privately to remonstrate against such needless and wanton destruction. The unusual abundance of this species and of the waxwing during the past winter, is also commented on in Mr. Stevenson's *Miscellaneous Notes*.

The year's proceedings commenced by a discussion on the hibernation of swallows, evoked by a note from the Rev. E. A. Bloomfield, who informed the Society—"that a supposed swallow which was seen by some men about thirty years ago to leave the surface of a pond in the beginning of March, upon being caught

proved to be a storm petrel." Thus now, as in the days of Gilbert White, the knotty point as to whether or no there are not some swallows which do not actually migrate at all, is occasionally discussed; and what the Selbornian Naturalist wrote an hundred years ago is still applicable in our day:—

“Amusive birds—say, where your hid retreat
 When the frost rages and the tempest beat?
 Whence your return,—by such nice instinct led
 When spring's soft season lifts her blooming head?
 Such baffled searches mock man's prying pride,
 The God of Nature is your secret guide.”

In *Entomology* Mr. Barrett has been, as usual, the chief contributor. A paper on the Camberwell beauty butterfly was read by this gentleman at the September meeting. Mr. Barrett mentioned that the first of these butterflies which appears to have been observed in Norfolk was in May, 1839, near Norwich; and that during the past year a large number had been seen in different parts of the county, especially in the vicinity of Sherringham.

In the discussion which followed Mr. Barrett's paper, it appeared to be the opinion of the Entomologists present, that the sudden and irregular appearances of these butterflies are to be attributed to some peculiarity in the season favouring their development—that the eggs may remain dormant until such circumstances occur—and that sound, perfect insects are doubtless to be found every year which continue the race—but that their occurrence in numbers is owing to climatic influence, and certainly not to immigration.

Mr. Barrett exhibited at the July meeting a magnificent collection of Nocturnal Lepidoptera collected during this season; and Mr. Bridgman exhibited three specimens of the leaf-cutting bee, and made some remarks on their habits and economy apropos of a specimen of their craft shown by Mr. Fitch, which consisted of a piece of board taken from the roof of East Harling Church containing the cell borings of this insect.

In September, Mr. Bridgman exhibited a bee's nest (of the species *Anthophora acervorum*) formed of clay, found by him in a bank near Norwich; he showed the perfect male and female

insects, and also a parasite peculiar to this species, (*Melecta armata*), and made some interesting remarks on its habits.

Botany. The most valuable contribution of the year, and the one which will also be most acceptable for publication in our *Transactions*, is that of Mr. Plowright, of Lynn, consisting of a List of Fungi gathered by himself in West Norfolk, and comprising more than 800 species. Although not a member of our Society, Mr. Plowright has not only kindly presented us with this valuable addition to our county Flora, but has liberally offered to pay for the illustrations; the best thanks of the Society are therefore doubly due to this distinguished Fungologist for his disinterested contributions.

A paper contributed by Mr. Jecks, of Northampton, was read at the first meeting of the Society on *The Law of Natural Selection in relation to Colours and Scents of Plants*.

Mr. Jecks attempted to prove (1) that the colours of plants were due to different degrees of absorption and radiation of different coloured rays of light; (2) that the scent of flowers was in an inverse proportion to their brilliancy of colour, *i.e.* that bright coloured flowers had less scent than dull coloured ones, which latter were thus more attractive to insects, which, by diffusing pollen, aided their propagation; (3) that dull coloured flowers faded less rapidly than bright coloured ones, because the tissues of the former did not absorb so many bright coloured rays of light as the latter, and, therefore, did not radiate colour so much, and had thus an advantage over the other in this respect.

On these propositions Mr. Jecks set up his theory, that dull colours and sweet scent, gave to plants possessing them a real advantage in the struggle for life, for which the Flora as well as the Fauna are supposed to be continually battling.

I need scarcely remind you of the interesting discussion to which this paper gave rise, in which Mr. H. Geldart chiefly took part; this gentleman objected to Mr. Jecks' data, contending that in the Flora with which we are best acquainted, bright coloured, *i.e.* white and yellow flowers, are more abundant than dull coloured ones, and that pure bright colour was no bar to delicious perfume.

Mr. Geldart named, amongst others, the *Jasmine*, *Gardenia* and *Tuberose*, as examples, and referred to the carrion plant to show that dark colouring was not incompatible with a most disagreeable odour. Mr. Barrett told us, that the sweetest flowers were not the most attractive to insects; and the discussion ended by a proposition asking Mr. Jecks to favour the Society with the observations and facts on which he grounded his opinions. Mr. Jecks very kindly answered this invitation by another paper on the same subject, of which—as I regret I had not the opportunity of hearing it—I am unable to give you any account; but I gather from the minutes of the Society's proceeding that, although he entered more fully into his theory, he did not, any more than on the former occasion, convince the members of the truth of it, or supply the facts on which it was based.

Mr. Jecks' paper is the only one in which, during the past year, any allusion has been made to the views and opinions of Mr. Darwin. This is a matter for regret, as there are no subjects so suitable for the consideration and discussion of such a Society as this, as the various debateable points which have been raised by the author of the "Origin of Species." It was on this account I endeavoured to induce Dr. Bateman to read to this Society the paper which he delivered at the Victoria Institute of London, and which gave rise to a prolonged controversy in the columns of a local newspaper, between the author, a Mr. Lyon, and one of our members, Mr. F. Harmer. Dr. Bateman's paper has, however, he informs us, considerable theological bearings, and he considers it more suitable for the Churchman's Club than for the Naturalists' Society; this I regret, as issues so important as those Dr. Bateman has raised, would be much better discussed in a scientific society, than in a theological club, or in the columns of a newspaper but this is not the time, although it certainly is the place, to discuss these matters. I content myself by simply saying, that the "origin of species," the theory of evolution, and other Darwinian doctrines, cannot be proved or disproved by newspaper controversy, or theological discussion. The experience and history of the past will, doubtless, be repeated, when the prejudice which at present

surrounds these theories is removed, for there can be "no real antagonism between science and religion, nor need the religious sentiment be banished in the ever advancing tide of physical science."

On this point a learned professor (Jowett) only a few days since observed, "Forty years ago the antiquity of the earth was as much derided as the theory of development is, and twenty years ago the antiquity of man was equally derided, yet no one now doubts that the earth has existed for millions of years, and man for hundreds of thousands. Experience teaches us caution," we must therefore suspend, and not pre-judge the questions as to the "development of mankind," and the "survival of the fittest."

Pardon this digression.

As usual, we have to thank Mr. Burcham and Mr. Bayfield for exhibiting various botanical specimens. Mr. Burcham has, on two or three occasions, given us the treat of a sight of his skilful and artistic grouping of rare and beautiful wild flowers.

The last contribution read to the Society was by myself, on *Edible Fungi growing in Norfolk*. To this paper I need not further allude, it having been before your notice so lately.

The papers which are not embraced in my tripartite arrangement of our year's proceedings are by our Honorary Secretary, Mr. Southwell. This gentleman read some notes on *The Water Shrew*, a dead specimen of which he found, for the first time in Norfolk, near St. Bennet's Abbey, on the occasion of the excursion of the Society to that interesting spot. Mr. Southwell also exhibited two specimens of the oared shrew, and expressed an opinion that both species, if more keenly looked for, would prove more common than is supposed.

At the December meeting, Mr. Southwell read a valuable paper on *The Otter*, in which he described its structure and mode of life, and gave details of its distribution through the county, entering into many interesting, and but little known particulars as to its mode and time of breeding, and the peculiar nest which it constructs in the flat, swampy districts of this county.

I have thus, gentlemen, reviewed the contributions which have

been presented for our consideration and instruction during the past year, and although they may be neither so numerous nor so important as in previous years, still they constitute in themselves a proof of the advantages which accrue to all who belong to such a Society as ours, and are thus afforded an opportunity of being edified and instructed by interesting and practical papers on natural science.

I am sometimes asked, of what use is the Naturalists' Society? what end does it serve? what good purpose does it fulfil? I reply, that it not only tends to advance science in our midst, and thus improves our minds, and adds to our knowledge, but it also enlarges our hearts, by bringing us into frequent friendly intercourse; occupied, as most of us are, in different callings, our Society must necessarily embrace men of varied attainments, and possessing knowledge on different subjects, amongst whom a frequent interchange of thought and opinion on matters appertaining to natural history must be productive of good and advantage, not merely to themselves, but to the scientific pursuits in which they are severally engaged.

It is to be hoped that our Society also affords the means and opportunities for promoting a taste for the study of natural history amongst those who have not hitherto cultivated it—likewise it may afford pleasure to others who, although not themselves pursuing any particular branch of scientific research, may like to spend an evening with those who do, or may be induced to join, for the sake of our excursions, and the health, exercise, and amusement they afford. Of these excursions I will now speak. One of the objects of the Society is the investigation of the natural history of the district in which we live; to this end we devote some part of our time to the study of "nature out-of-doors," as it has been aptly termed, and collect specimens for a closer examination and record at home. During the past year the members made *four* excursions—(1) Fritton Decoy; (2) Scoulton; (3) Ranworth Broad; (4) Hemblington, S. Walsham, and St. Bennet's Abbey. I regret that other engagements prevented my attending three out of the four excursions. Of the trip to Fritton Decoy, I can say that it was so

interesting and agreeable, that it will well repay a second visit, especially as Major Leathes has promised to afford the Society every facility for visiting the heronry in Herringfleet Wood.

I cannot, however, omit to express my regret that, for the want of better organization, the excursions have neither been so numerous attended, nor so successful as could be wished. I trust that this defect will be remedied in the year we are about to commence, for I look upon the excursions as essential to the well-being and success of the Society, as they are not only the motives many have for joining our ranks, but are also incentives towards the diffusion of a taste amongst the hitherto indifferent for those studies in which we, as naturalists, so much delight. In this opinion I am supported by the President of the Liverpool Naturalists' Society, who says, "Large numbers join our excursions who are not particularly interested in any branch of natural science, and this is just what the chief object of our Club renders a desirable circumstance; the busy appearance of our workers, flushed with exercise, animated with success, is a practical and suggestive lesson on the difference of the amount of pleasure afforded by a walk *with* a special object, and a walk *without* one."

"Culling from woods, and heights, and fields,
Those untaxed boons which nature yields."

During the past year fifteen new members have joined the Society, and seven have withdrawn. Death has removed one—H. Kett Tompson, Esq. Our financial condition is satisfactory, and shows an increased balance of £5 over that of last year; this will enable us to publish our *Transactions* as usual, but, at the same time, it has been a matter of regret to the Journal Committee, that they have not sufficient funds to permit them to include in this year's publication the list of Norfolk Fishes, which has been kindly placed at the disposal of the Society by Dr. Lowe, of King's Lynn.

Gentlemen, I will not detain you longer, but, in conclusion, congratulate the Society on the successful termination of its fourth year, as well as on the fact that it has succeeded in drawing together

the naturalists of the city and county, and in attracting the attention of many living at a distance, who have kindly contributed papers to our monthly meetings. Allow me, at the same time, to urge those who have hitherto been such zealous supporters not to allow their zeal to diminish; and to those who have as yet been unable to favour us with contributions, may I venture to express a hope that they will, in the future, do their part to lend a helping hand to the Norfolk and Norwich Naturalists' Society.

I.

ON THE ORNITHOLOGY OF SPAIN.

Communicated by

HOWARD SAUNDERS, F.Z.S.

Read 27th August, 1872.

UNTIL within the last few years but little was known of the Ornithology of Spain, and that little was principally due to German naturalists, for our occupation of Gibraltar seemed to have proved of no service in this respect. Latterly this reproach has been, to a certain extent, taken away, so far as the Central and Southern portions of the Peninsula are concerned, but there are other very important districts which have never been explored, and which, if they produce no absolutely new European Palæartic forms, will probably throw some light upon the distribution of species. Such are the Asturian Mountains, the Spanish Pyrenees, and the grand range of the Sierra Nevada, and although the latter has probably a fauna almost identical with that of the Atlas, it has the merit of being far more accessible. On the other hand, although Africa north of the Sahara possesses an essentially European or Palæartic fauna, yet there are several species on both sides of the Mediterranean, which appear unwilling to cross even the narrow Straits of Gibraltar, and to these I shall call attention in their proper place; I shall not attempt to enumerate every species, but will briefly notice such of the inhabitants of the Peninsula as appear to be of interest.

Following the usually accepted arrangement of commencing with the *Raptores*, we find the black vulture (*V. monachus*, L.) generally distributed throughout the country from the Pyrenees to Andalusia, excepting in the cultivated regions on the east coast, and it breeds early in April wherever it finds pine trees suitable for its enormous nest. The griffon (*Gyps fulvus*, Gm.)

and the Egyptian vulture are also abundant, the latter, however, less numerous, and generally in pairs. The noble l ammergeier (*Gypaetus barbatus*, L.) has its principal strongholds in the two extreme ranges, the Pyrenees and the Sierra Nevada, where it may generally be observed soaring for hours with scarcely a perceptible movement of its wings; at the same time a pair or two are to be found in every mountain range with which I am acquainted throughout the whole of the Peninsula. Its name, "quebranta-huesos," or "bone-smasher," is well bestowed, there being ample evidence of its custom of taking bones up into the air and letting them fall, the result being that the bone is split, whatever the intention may be. Utilitarians, as are Spaniards in general, naturally suppose that this is done to get at the marrow, but probably the object is to reduce the bone itself into fragments convenient for swallowing, as without large quantities of bones this species cannot be kept alive, or at least will not thrive in confinement. At the same time I may be permitted to express my utter disbelief in any of the stories of this bird carrying off young children, especially one of nearly three years of age, an event which we are asked to believe on the strength of what some one else told to Naumann as having happened more than a century ago, and duly quoted ever since down to the very latest history of the species. When anyone will give me the slightest proof that the bearded vulture was ever known to clutch *and fly away with* anything of seven or eight pounds, the average weight of a new-born infant, I shall then be more able to swallow the story of the three year old; till then I beg to be excused this stretch of credulity. One glance at the bird's feet and talons should be sufficient to shew the improbability, to use a mild expression, of this statement; the real robber was doubtless the golden eagle.

The golden eagle (*Aquila fulva*) is generally distributed throughout the country; more numerous perhaps in the mountains but far from rare in the wooded plains, to which the Spanish form of imperial eagle (*Aq. adalberti*, Brehm.) is almost entirely confined during the breeding season. The young of this species from their tawny plumage were for some time supposed to be specimens of the tawny eagle (*Aq. nerioides*, Cuv.) but after careful examination of a very large series, I can only refer to a single specimen of the latter as having been obtained in Spain; it is in Lord Lilford's

collection, and was shot near Aranjuez about forty miles from Madrid. The spotted eagle (*Aq. nœvia*) is only, so far as I know, an occasional visitant. On the other hand Bonelli's eagle (*A. Bonelli*) and the little booted eagle (*A. pennata*) are common, the former nesting in rocks, the latter in the woods. At Gibraltar there are at least two pairs of Bonellis, and they seem by no means disturbed by the morning and evening gun; indeed raptorial birds, as a rule, are rather attracted than dismayed by the report of a gun, and a shot will generally bring up several species on the look out for something which may fall to their share. Those in England whose knowledge of *raptores* is confined to the much persecuted kestrel, sparrow hawk, and barn owl, may possibly be of a different opinion as to the *familiarity* of the race, but I am writing of a country where there are no pheasants, and where partridges, hares, rabbits, woodcocks, snipe, and ducks appear well able to maintain themselves against such a stock of winged and four-footed vermin as Turkey alone can rival.

The sea eagle (*Haliaetus albicilla*, L.) although common in Eastern Europe down to about the same latitude, is only a rare visitant to Spain, but the osprey (*Pandion haliaetus*) breeds at several places along the sea cliffs, there being one nest at Gibraltar; and at the island of Dragonera off Majorca, in a cliff some 1100 feet high and about 300 feet from the summit, is another, which has evidently been resorted to for ages. The reptile-eating short-toed eagle (*Circæetus gallicus*, Gm.) is abundant in the marshy districts where there is some moderate sized timber; and with regard to this species I must, at the risk of destroying at once my reputation for veracity, give a list of the "happy family" I once found in possession of an old wide-spreading cork-tree. First there was the huge nest of this eagle with its one large white egg; on another branch a pair of black kites (*Milvus migrans*, Bodd) were making their nest; a kestrel was sitting on its nest on another branch; a white owl flew out of the riven trunk as one of us climbed up; lower down was a jackdaw's nest with one egg, and I was made uncomfortably aware of a hoopoe's nest in the same trunk by bedaubing my hand with its odoriferous lining, for as most ornithologists are aware, this bird uses ordure, especially human, in the plastering of its nest. I have no doubt that, as is almost invariably the case, the foundation of the eagle's nest held

its colony of Spanish sparrows (*Passer hispaniolensis*, Temm.), but I do not positively recollect them at the present moment, when I am without my notes, and, like the Yankee who made the famous shot, "I wouldn't tell a lie for a dirty little sparrow."

The common buzzard is generally distributed, and as I obtained an immature specimen of what Mr. J. H. Gurney has pronounced to be the African buzzard, (*Buteo desertorum*, Daud.) it is very likely to be found breeding, as it is common in Barbary and Morocco. The honey buzzard (*Pernis apivorus*, L.) occurs in vast numbers at the seasons of migration, when I have seen them like flocks of rooks at sunset. The kite (*Milvus iclinus*, Savig.) as a resident, and the black kite (*M. migrans*) as a spring and summer visitant, are abundant, and I have one fine adult specimen of the black-winged kite (*Elanus caeruleus*), a species which has, I am informed, been recently obtained in Ireland: v. *Ibis*, 1872, p. 470.

Of the true falcons, the peregrine is generally distributed, and I have a single specimen of its miniature, the little Barbary falcon, which is probably a resident in some of the southern mountains. The true lanner (*F. lanarius*, Lin.), so often confounded with the saker, owing to the latter having had the name *F. lanarius* (Pallas) bestowed upon it, has been once obtained, and may prove to be a resident overlooked: if so the wild districts between Granada and Lorea will probably prove its stronghold. The little merlin is a visitant, but the hobby remains to breed, whilst its long-winged congener the eleonora swarms in the cliffs of the island of Dragonera, though rare elsewhere. Both the common and the lesser kestrels are extremely numerous and occasionally the red-footed falcon (*F. vespertinus*) pays a flying visit. Of the short-winged hawks, the goshawk and the sparrow hawk are both residents, and the marsh and Montague's harriers are abundant, especially the former; the hen harrier I obtained in autumn and winter only.

The little owl (*Carine noctua*) is very common, but I never met with the north African species (*C. meridionalis*). The wood owl (*Strix aluco*) is doubtless a resident, but I did not actually find it breeding, whereas the long-eared owl breeds as far south as Granada. The short-eared owl occurs in autumn, when the cape owl (*Otus capensis*) makes its appearance, for the discovery of which we are indebted to Major H. L. Irby, well-known to Norfolk naturalists. The barn owl is common, and the largest

and the smallest of the European horned owls, viz. the eagle owl, and the scops, are often to be heard at the same time wherever the spurs of the mountains are fringed with olive and orange trees.

The great black woodpecker is, I believe, confined to the pine forests of the Pyrenean districts; and beyond recording their occurrence, I can say but little of the great, middle, and lesser spotted woodpecker. Our green woodpecker (*Gecinus viridis*) is, however, represented by a species apparently intermediate between *G. viridis* and *G. canus*, which I have recently described in the *Proceedings of the Zoological Society*, under the name of *Gecinus sharpii*, after the talented joint-author with Mr. H. E. Dresser of the *Birds of Europe* now in course of publication. This species, which has grey cheeks, and generally brighter colours, with a moustache in the male of brilliant crimson, ranges at least as far as the Guadarrama mountains, but at the Pyrenees yields to the common form. The Algerian species, *G. vaillantii*, has not yet been discovered in any part of Spain. The wryneck and the cuckoo are both spring visitants, but the next in order, the great spotted cuckoo, was long considered to be more of an African than a European bird. It is, however, very abundant in spring, depositing its eggs in the nest of the common magpie, and occasionally in that of the raven. Of rollers, bee-eaters, and hoopoes, suffice it to say they abound, and the common and red-necked goatsuckers arrive in large numbers in spring; the latter perhaps is more common in the south, where it remains to breed. As this species has been obtained in England by Mr. John Hancock, and may be confounded with its congener, it may be as well to state that the red-necked may always be distinguished by its larger size and lighter and more rufous colour; the russet collar is an infallible test in the adult, when it is tipped with white, but is not so clear in young birds.

All the true European species of swifts and swallows are found in Spain, and the same may be said of the flycatchers, the little red-breasted flycatcher, (*Erythrosterina parva*), which has lately visited our shores, being a regular autumn migrant to S. W. Spain, where it remains till March. It partakes of the pugnacious habits of the robin, a single bird taking possession of a garden, and maintaining itself with obstinacy against any intruder of its own species. Of the shrikes, the woodchat is the commonest; the vinous-

breasted *L. meridionalis* taking the place occupied by *L. excubitor* in other parts of Europe, and by *L. algeriensis* in North Africa. As regards the North African bush shrike, *Telephonus tschagra*, I am not aware of any *authentic* record of its occurrence in the Peninsula, although a careful watch has been kept for it during the last four years.

The tits are not very numerous, but the crested titmouse (*Parus cristatus*) is a species which we should hardly have expected to find nesting in the extreme south of Spain, and for this we have again to thank Major Irby, who first observed it near Gibraltar. Coming to the *Turdidae*, it is remarkable that, whereas the redwing is very abundant in winter, yet the fieldfare is extremely rare at that season, or, at all events, it must occur at considerable intervals, as I have never been able to procure one in upwards of five years. The song thrush is common in winter, but does not breed, whereas the blackbird is resident throughout the year, and even the ring ouzel nests in the Sierra Nevada range. The dusky bulbul (*Ixos obscurus*) is another species abundant in North Africa, but there is not, so far as I am aware, a single instance of its occurrence in Spain. French dealers are the authors of its insertion in the strictly European list, as they are for several other species, all of which are abundant in Algeria and Morocco, but which, for some mysterious reason, have never crossed the Mediterranean.*

The *Saxicolinae* are well represented, both as regards species and numbers, and both the hedge and Alpine accentsors are to be found in suitable localities. The same may be said of the warblers, to enumerate which, would be to copy down the European list almost entire. Strange to say, they do not appear to breed any earlier than with us, and in many parts they seem to continue nesting later than in our more temperate climate: to this there are one or two exceptions, but it is a general rule. The rufous warbler, erroneously styled the rufous *sedge* warbler in British lists, is a frequenter of dry lanes and cactus-hedges, indeed, the most arid spots where anything will grow at all. Of the wagtails and pipits it is needless to enumerate the species.

Arriving at the larks, we find that two North African species, which might be expected to occur, are as yet unrecorded, viz.,

* I believe that more than one British ornithologist imagines that *Tangiers* is in *Spain*; for the benefit of such, I may state that it is in *Morocco*.

Aleimon desertorum and *Alauda dupontii*: neither did I meet with *A. lusitanica*, which has long been ascribed to Portugal, whence, however, I have never seen an authentic specimen. The common and resident species are the crested, calandra, and short-toed larks; the sky and woodlarks only occurring in winter in southern Spain. The buntings seem to be merely the usual western and central forms, no examples of any of the eastern species being as yet recorded, but the finches require a little notice.

First, as regards the sparrows: the common species in the towns and villages is identical with our familiar bird, but there is another species, known as the Spanish sparrow, (*Passer hispaniolensis*) which, though very abundant, is less frequently observed, owing to its being a country cousin. This is the sparrow which is so partial to the foundations of the nests of birds of prey, especially large ones, for it generally eschews the neighbourhood of the smaller hawks. The eisalpine sparrow, which replaces our own *P. domestica* in Italy, certainly has occurred in Spain, but I have hitherto only seen a single specimen. The tree sparrow is local, and more abundant in the eastern provinces. The chaffinch is identical with our own sprightly bird, the Algerian form, *F. spondiogena*, not having as yet been captured on this side of the Mediterranean. Our bullfinch is conspicuous by its absence, at least in the southern districts, although the hawfinch is abundant, and the crossbill is a common resident in the Balearic islands. The southern breeding range of the last species is probably the Atlas range, where Salvin found a family party on the 26th of March.

But it is amongst the *Corvidæ* that we find a bird whose geographical limit is, perhaps, the most remarkable of any European species. I refer to *Cyanopica cookii*, commonly known as the azure-winged magpie, although, in external appearance, cry, and nidification, it is much more of a jay, occupying a place between our *G. glandarius* and *Perisoreus infaustus*, the Siberian jay. This species, although somewhat local, is extremely abundant as far north as the Guadarrama, and even a trifle beyond the watershed, but it does not appear to cross the valley of the Ebro, or even to stray into the northern provinces of Spain, or the south of France: on the other hand, it has never been obtained in North Africa, although abundant within sight of that coast. But after

traversing the whole of Europe, and a great part of Asia, we find, in the north-east of the latter continent, a species first described by Pallas as *Pica cyana*, scarcely to be distinguished from the Spanish form, except by the white tip at the end of the tail, about half to three-quarters of an inch in breadth, and which occasionally is found, to a less extent, in the Spanish species. This slight difference, in the case of such complete isolation, is very remarkable, and as the isolation probably took place at a somewhat remote period, it may give us an idea of the lapse of time required to produce any appreciable alteration in *some* forms, whilst others are well known to be far more pliable, and more subject to variation. Two other forms of this family, the black-headed jay, (*Garrulus cervicalis*), and the Moorish magpie, (*Pica mauritanica*), do not as yet appear to have extended their range to the Peninsula.

The *Columbidae* call for no particular remark.

The excursions of Pallas' sand grouse (*Syrrhaptes paradoxus*) do not appear to have reached the Peninsula, their nearest approach being at Perpignan, just over the French frontier, on the north-east of Spain. The other two European species, *Pterocles arenarius*, and *P. alchata*, are abundant, the former being the more numerous in the north, and the latter in the southern districts. The capercaillie is found in the Pyrenees, and it is said to inhabit the Asturian forests, but I have not worked those provinces, and specimens, and information regarding *any* of the *Tetraonidae* from any part of Spain would be of great service. The partridge of Spain is the red-legged species, (*P. rubra*), except in the north, where our grey bird is also found; and on the Rock of Gibraltar the Barbary partridge, which has, doubtless, been introduced from Morocco.

Next in order I will take the cranes, a family usually placed next to the herons, with which, however, they have far less affinity than they have with the bustards, both in their food, and in their nidification. Our knowledge of the breeding haunts of the common crane being principally derived from the late John Wolley's account of its nesting in Lapland, it was with some surprise that I found it breeding in the marshes of the Guadalquivir in the extreme south, where, however, I did not discover the nest of its congener, the Numidian crane, (*Grus virgo*), although the latter is abundant

in winter. The cranes are great devourers of acorns, and in the autumn prove excellent eating.

As regards the Great Bustard, Mr. Stevenson's exhaustive description, in the *Birds of Norfolk*, records its haunts and habits in all parts of Europe, and leaves me nothing new to say about Spain, where it is still, and will long remain, an abundant species: some further details of the localities it frequents will, however, be found in the *Ibis* and in the *Field*. On undulating and broken ground, on the verge of cultivation, the little bustard is very common, and the African houbara occasionally pays a visit to the Peninsula, as does also the cream-coloured courser. The thicknee is a resident, especially frequenting the stony river-beds, when, as is usually the case, during ten months of the year, they are devoid of water. In the marshes, which, however, are very dry ones, according to our idea of the word, the lively pratincole is a feature which soon obtrudes itself upon the stranger, for it is anything but a shy bird, being unmolested as useless for food.

But my communication has already reached an unwarrantable length, and I must leave the waders and water-birds untouched. I suppose the influence of the unrivalled collection of *Raptores* in this Museum has proved too much for me, for that family has certainly engrossed an undue amount of space in this paper; yet I can hardly regret this, for it is, after all, with that family that the ornithological fame of the Norwich Museum is chiefly identified.

II.

ON VANESSA ANTIOPA.

BY C. G. BARRETT.

Read 24th September, 1872.

THE sudden appearance in considerable numbers of that rare butterfly the Camberwell Beauty (*Vanessa antiopa*) in this county, as well as throughout the east and south-east of England, seems to call for some special notice.

This species is common in most parts of the continent of Europe, extending as far north as Lapland, and seems to be pretty constant in its numbers; but the great uncertainty about its appearance in this country has been noticed for a long period. Moses Harris, writing in 1775, does not speak of it as any rarity, but Berhenhout in 1789 writes, "very rare in this kingdom." In 1793 it received the name of "The Grand Surprise," from Harris and the Society of Aurelians, (as Entomologists were then called,) of which he was a member, on account of its sudden appearance in extraordinary numbers. Donovan (1794) states that there have been several instances in mild seasons of its being as common as the Peacock and Admiral (*Vanessa Io* and *Atlanta*), and that in 1793 it was as plentiful as the common garden whites usually are.

There, however, appears to be no record of its occurrence in Norfolk till 1839, when Wood, in his *Index Entomologicus*, records its occurrence near Norwich, in May. In 1846, which has been called the Antiope year, (a name which it can now hardly retain,) no specimen seems to be recorded in Norfolk, but Mr. John Henry Gurney, jun., tells me that his father saw one on March 22nd, 1847, at Easton, near Norwich. Its next occurrence seems to have been in 1869, on September 3rd of which year two specimens were taken at Sparham, by Mr. Frank Norgate. The Rev. T. H. Marsh informs me that two more were seen that season, one near Horsford and one at Marsham. This seems to have been a favourable year, as upwards of a dozen were recorded from different parts of England. In 1871 a specimen was seen at Buxton, by my friend Mr. F. D. Wheeler. It was sitting on a bleeding alder tree, but would not allow of a near approach. This specimen seems to have been the herald, (or perhaps a progenitor,) of the grand appearance this season.

The first specimen of which I have any record for this year, was seen on August 20th, by the Rev. T. H. Marsh, of Cawston. The next day he saw two and took one, and on the 23rd and 24th captured three more in the most perfect condition, apparently fresh from the pupa. These were taken about sugar placed on the trees to attract them. On the 24th one was seen by Mr. J. H. Gurney, jun., at Northrepps, sitting on green brake. On the 26th another was taken by Mr. Marsh at sugar, and one on sap exuding from a

wounded tree. On the same day three specimens were seen by Mr. A. W. Partridge, at Ketteringham. These seem to have been very tame, rising quietly from the road and settling on hazel bushes. On the morning of the 28th, one was seen by Mrs. Bridgman to alight on the glass of the conservatory in Mr. Bridgman's garden, in St. Stephen's, and there it remained for half an hour, until a net was obtained and it was captured. Two more were seen by Mr. Bridgman in the same garden on subsequent days. On this day (28th) three more were taken by the Rev. T. Marsh, and one by the Rev. G. Norris, at Cawston, about sugar, two of them rather worn; and on the same afternoon when searching the country roads, Mr. F. D. Wheeler and I saw a lovely specimen flying along a hedge side in the Plumstead road. It seemed at first as though about to alight, but our nets must have looked too formidable, for it flew over and disappeared. The next day (29th) Mr. Wheeler went over the same neighbourhood, and saw two more flying round oak trees beyond Mousehold, but they kept out of reach. Two were also seen flying about the avenue at the Asylum, Old Palae road; and three (one of which I have the pleasure of exhibiting) were taken, and a fourth seen by Mr. Hiekling about some bleeding aspens, near the river at North Heigham. Mr. Clare S. Read records one seen by him on the same day, on his farm at Honingham Thorpe, and two more were taken by Mr. Marsh at Cawston.

On the 30th another specimen was taken about the aspens at North Heigham by Mr. Amis.

On September 1st one was seen flying about the trees close to the new church in the Old Palae road, and another sunning itself on a window in Distillery street; but neither of them were captured.

On September 2nd, Mr. Partridge, of Sprowston, very kindly sent a conveyance to take Mr. Wheeler and me to Ketteringham, to the place where he had seen three specimens a week before. Almost immediately on our arrival we saw one flying along a hedge. It settled on an oak tree, but declined to be caught, and finally disappeared over the woods. We spent four or five hours there without further result, a gale of wind having arisen and made insects scarce.

Besides the specimens which I have enumerated, many others

have been recorded without dates. Mr. Eedle, Lord Walsingham's collector, took eight beautiful specimens at Horning, several of which appeared to have but just emerged from the pupa. Two were taken at Cantley in the last week of August by the son of the station-master, Mr. Thos. Harding, and were recorded in the *Daily Press*, these have been seen by Mr. Stevenson; and in the *Mercury* there is a notice that three specimens, and one of *Argynnis lathonia*, have been taken at Bradwell Rectory.

Mr. H. M. Upeher, of Sherringham, informs me that he has seen fourteen:—one each on August 20th and 21st, one at Salhouse on the 23rd, the next day five at Sherringham and one at Hempstead, and five more at Sherringham on the 24th. Most of them were in the midst of the covers in an open green lane. Mr. C. M. Lowe, writing to the *Entomologist*, says, "we have seen eleven here within the last few days;" and the Rev. J. L. Brown tells me that a clergyman at Matlask also took eleven specimens at Sherringham, there must, therefore, have been a large number in that neighbourhood.

Two specimens have been seen at Buxton by Mr. Gambling; the Rev. J. W. Colvin informs me that several have been taken near Yarmouth; and the Rev. T. Marsh records in the *Norfolk Chronicle* the capture of one at Diss.

The last specimen of which I have any account was taken by the Rev. T. Marsh, on a bleeding tree in his own glebe at Cawston, on September 13th; three having been seen there a few days previously. With these exceptions I have heard of none since September 2nd, and am of opinion that the majority either left this district, or went into winter quarters for hibernation, during the storms of wind which blew about that time. If, as I hope, the latter is the case, we may hope to see a few of these beautiful insects sunning themselves in the warmer days of next April and May.

Since the above was written a notice has appeared in the *Norfolk Chronicle* of the occurrence of a specimen at North Creak. On January 5th a young lady was passing under some trees, when it fell in a torpid condition upon her hat.

III.

FAUNA AND FLORA OF NORFOLK.

PART III. FUNGI.

Communicated by

CHARLES B. PLOWRIGHT, M.R.C.S.

Read 29th October, 1872.

At the present time more interest appears to be taken in Mycology than was the case some years ago, when, in point of fact, it languished in comparative neglect. From the time that James Sowerby published his magnificent work on *English Fungi*, at the end of the last century and the beginning of this, until within a comparatively recent period, fungologists in Norfolk have been few and far between; nor, indeed, has the study of fungology been at all general throughout the kingdom. Now, however, we have evidence that it is coming more to the front, especially from what has been said and written during the last few years upon edible mushrooms.

As a county, Norfolk has already left its mark in our mycological hand-books, from being the habitat of many rare and highly interesting species, hence the desirability of looking over our notes and seeing what species have at any past period found an abode here, and refreshing our memories as to those now met with in our woods and pastures.

Sowerby visited Norfolk on more than one occasion and mentions finding several species of fungi in the neighbourhood of Norwich. Dickson, in his first *Fasciculus*, published in 1785, gives Gillingham and Earsham as the habitats of *Geaster coliformis*, a plant the sight of which now would gladden the heart of the most lethargic fungologist.

That the subject is difficult no one who has worked at it will dispute. One great cause of this is the evanescent nature of the

majority of the larger species, and the fact that owing to certain meteorological conditions, numbers spring up in a few hours only to fade and vanish before the mycologist has time to grasp their characters in their full integrity. The microscopic species, however, occur at all seasons of the year, and as a rule will keep unimpaired for years.

The work of compiling this list, which with the exception of a list of seventy-two species contributed by the late Rev. Geo. Munford to the botanical portion of White's *Norfolk Directory*, is I believe the first attempt to tabulate the Norfolk fungi, has been to me a great source of pleasure, for it has brought up reminiscences of many very happy days spent in hunting funguses; memories of autumnal rambles in the sombre fir woods in search of *Agarics*; of winter forays, when, armed with great coat and "black-grains," cold and wet have been defied, in the search for *Sphaerias*; and of pleasant spring walks when *Morels* and *Pezizas* were the source of attraction.

This list embraces upwards of 800 species, and includes all those fungi mentioned by Sowerby as occurring in the county; the more critical and interesting of these latter have been represented by a figure. Those species distinguished by an asterisk have not been recorded by any recent observer; at the same time no doubt can exist as to the propriety of their admission into this list.

To the Rev. Kirby Trimmer, of Norwich, I am much indebted for a very valuable list of East Norfolk fungi, and to Mr. M. C. Cooke for a list of the species found by him at Irstead, Neatishead, and elsewhere in the county.

Mr. D. Stock, late of Bungay; Dr. John Lowe, of King's Lynn; Mr. T. E. Amyot, of Diss; Mr. Frank Norgate, of Sparham; and Dr. Metcalfe, of Beeches, have all assisted most cordially in the work, and to them my best thanks are due.

The figures are from the pencil of my talented friend Mr. W. G. Smith, for those of the *Geasters* I have to thank the *Gardeners' Chronicle*, and for those of *Xerotus* and *Sparassis*, Mr. M. C. Cooke.

A LIST OF THE FUNGI KNOWN TO OCCUR IN THE
COUNTY OF NORFOLK.

Division I. SPORIFERA.

Fam. I. HYMENOMYCETES. Order I. AGARICINI.

- AGARICUS VAGINATUS. Bull. Not very common. Middleton, Aylsham.
- „ PHALLOIDES. Fr. Common.
- „ MUSCARIUS. L. Common in autumn under birch trees, I have never found it elsewhere. Felthorpe. Sparham.
- „ STROBILIFORMIS. Fr. Ringstead Downs.
- „ RUBESCENS. P. Exceedingly common in fir woods.
- „ ASPER. Fr. Foxley Wood, K.T.
- „ PROCERUS. Scop. Not very common, near Lynn. Thuxton, Sparham, etc. Mr. Amyot found it plentifully in October, 1859, but he has only seen it once since. One specimen measured $15\frac{1}{2}$ in. in height and $10\frac{1}{2}$ in. across the pileus.
- „ RACHODES. Vitt. Far more abundant than the preceding.
- „ BADHAMI. B. & Br. North Wootton, on a hedge bank, 30th October, 1871. The specimens found are figured in *Mycological Illustrations*, t. 35.
- „ CRISTATUS. Fr. Abundant.
- „ VITTADINI. Moretti. Mr. Amyot found this species under a gorse fence at Billingsford in June, 1856, the specimens were submitted to Dr. Badham. G. E. Frere, Esq. also found it at Kenninghall, in September, 1859; and it occurred again in 1862, at Roydon, near Diss.
- „ ERMINEUS. Fr. This plant grew in Dr. John Lowe's Fernery, at Lynn, in September, 1871; for its description vide *Fries Eprie.*, p. 15.

- AGARICUS GRANULOSUS. Batsch. Common, pileus either yellow or white.
- „ MELLEUS. Vahl. Not common around Lynn, I have only met with it twice. Mr. Amyot finds it near Diss.
- „ FLAVO-BRUNNEUS. Fr. Common in fir woods.
- „ RUTILANS. Schœff. On fir stumps, Castle Rising. Norwich and Ditchingham, *Sowerby*.
- „ VACCINUS. P. Ringstead Downs.
- „ TERREUS. Schœff. Common.
- „ CUNEIFOLIUS. Fr. Ashwicken Heath, 1872.
- „ SULPHUREUS. Fr. Folly Wood, Rising.
- „ GAMBOSUS. Fr. Abundant in the meadows round Lynn in May and June.
- „ GRAMMOPODIUS. Fr. Common.
- „ MELALEUCUS. P. North Wootton, May, 1871.
- „ NEBULARIS. Batsch. Not common in West Norfolk. October and November. Wickmere, Scolt, Sparham.
- „ CLAVIPES. Pers. Common. *Fr. Ep.*, p. 56. There is a figure of this in *Mycological Illustrations*, t. 31.
- „ ODORUS. Bull. Common.
- „ PHYLLOPHILUS. Fr. Folly Wood, Rising.
- „ FUMOSUS. P. Var. POLIUS. On the road side, Rising.
- „ MAXIMUS. Fr. Not uncommon. Rising. Blickling Park, K.T.
- „ INFUNDIBULIFORMIS. Schœff. Common.
- „ TRULLIFORMIS. Fr. I believe this plant is not of uncommon occurrence on exposed heaths, &c.
- „ GEOTRUPUS. Bull. Very elegant in form when well grown; usually it does not appear before the end of October or beginning of November.
- „ INVERSUS. Scop. North Wootton.
- „ FLACCIDUS. Sow. Castle Rising, abundantly in rings in the fir woods.
- „ CYATHIFORMIS. Fr. Common late in Autumn.
- „ NIGRESCENS. Lasch. Ringstead, 1870. Pileus, cream-coloured, gills crowded. The whole plant turns dark blue, then ash grey when bruised. *Lasch. Linn.*, No. 521; *B. & Br. Annals N. H.*, No. 1199; *Fr. Ep.*, p. 149, *Ag. mundulus*.

- AGARICUS FRAGRANS. Sow. Individuals of this species have been met with at almost every season of the year.
- „ LACCATUS. Scop. Exceedingly abundant. The “amethyst-blue” variety is by far the most uncommon.
- „ *DRYINUS. P. On ash, Ditchingham. Mr. Woodward.
- „ ULMARIUS. Bull. Lynn. December.
- „ OSTREATUS. Jacq. Not common. November and December.
- „ SALIGNUS. Fr. Castle Rising, not common.
- „ SEPTICUS. Fr. North Wootton.
- „ *MASTRUCATUS. Fr. Norwich. Mr. Pitchford. *Sowerby*.
- „ CYPHELLÆFORMIS. Berk. North Wootton.
- „ APPLICATUS. Batsch. Not uncommon.
- „ RADICATUS. Relh. Anything but common in the neighbourhood of Lynn, neither does it appear to have occurred elsewhere in the county. A pure white specimen was found on Wootton Marshes, October, 1869.
- „ FUSIPES. Bull. This species so common elsewhere I have only found twice.
- „ MACULATUS. A. & S. Abundant on heaths. “Not very rare in woods in Norfolk, on Mousehold Heath and other places.” *Sowerby*.
- „ BUTYRACEUS. Bull. Very common.
- „ VELUTIPES. Curt. Everywhere.
- „ CAULICINALIS. Bull. Common.
- „ CONFLUENS. P. Rising.
- „ VERTIRUGIS. Cooke. This is the *A. undatus* of Berkeley : *Eng. Fl.* v, p. 51 ; not the *A. undatus* of *Fries. Epic.*, p. 149, which is a *Clitopilus*. At the base of *Pteris* stems still remaining in the ground, Castle Rising Heath.
- „ CONIGENUS. P. Common.
- „ TUBEROSUS. Bull. Commonly growing upon dead and black *Lactarii*. Frequent.
- „ DRYOPHILUS. Bull. Common.
- „ EXSCULPTUS. Fr. North Wootton Heath.

- AGARICUS TENACELLUS. P. A larger plant than *A. conigenus* and occurring earlier in the year.
- „ ATRATUS. Fr. Bawsey. Ringstead.
- „ ROSELLUS. Fr. Ringstead, amongst larch leaves.
- „ PURUS. P. Everywhere. Tastes strongly of radishes.
- „ IRIS. Berk. This rare species grows abundantly in a fir wood at Castle Rising. The blue fibrillæ are obvious enough on the young plant but disappear after the first shower.
- „ LACTEUS. P. Castle Rising.
- „ GALERICULATUS. Scop. Very abundant.
- „ POLYGRAMMUS. Bull. Common.
- „ ALCALINUS. Fr. Common.
- „ ACICULA. Schœff. Not uncommon.
- „ SANGUINEOLENTUS. A. & S. Common.
- „ GALOPUS. Schrad. Common.
- „ EPIPTERYGIUS. Scop. Common. As the plant matures the pileus often becomes umbilicated.
- „ VULGARIS. P. Common.
- „ CITRINELLUS. P. Ringstead. The whole plant has an odour of new meal, gills lemon coloured.
- „ STYLOBATES. P. Common.
- „ TENERRIMUS. Berk. Not so common as the preceding.
- „ CORTICOLA. Schum. Frequent.
- „ *SETOSUS. Sow. "Found on fallen leaves of young beech in the plantations of Sir W. Jerningham, at Costessy, near Norwich." *Sowerby*.
- „ CAPILLARIS. Schum. Common.
- „ PYXIDATUS. Bull. Not uncommon.
- „ ONISCUS. Fr. Very common on heaths.
- „ MURALIS. Sow. Rising Church Wall.
- „ UMBELLIFERUS. L. Not very frequent.
- „ RUFULUS. B. & Br. North Wootton Heath.
- „ FIBULA. Bull. Both varieties of the English Flora are common in West Norfolk.
- „ TAYLORI. Berk. This has occurred two or three times on the salt marshes near Lynn. The pileus is always fleshy. Figured in *Mycological Illustrations*, t. 33.

- AGARICUS GLOIOCEPHALUS. Fr. North Wootton, June, 1871.
Rare; growing on manure buried in the ground.
The specimens found are figured in *Mycological Illustrations*, t. 33.
- „ ECHINATUS. Roth. Rising, 5th November, 1870, on chips in a carpenter's yard.
- „ CERVINUS. Schæff. Not very common.
- „ NANUS. P. Reffley. September, 1872.
- „ LEONINUS. Schæff. Boal Quay, Lynn, 2nd August, 1865, Miss Lowe.
- „ CLYPEATUS. L. Abundant in spring. Spores smooth and globular.
- „ COSTATUS. Fr. Very common.
- „ SERICETUS. Bull. Common.
- „ PRUNULUS. Scop. Not common.
- „ VARIABILIS. P. Everywhere. The pileus is usually white, but sometimes has a decidedly yellow tinge. It occasionally grows on living grass.
- „ CHALYBÆUS. P. Not uncommon. The dark edge of the gills is due to a fringe of blue hairs which disappear as the plant grows old.
- „ INCANUS. Fr. Ringstead Downs.
- „ LEVEILLIANUS. D. & M. Reffley Wood. Sept. 1872. Densely cæspitose. Ring distinct, white plicato-striate. Spores oval.
- „ ARRHENII. Fr. Not rare, in gardens, etc. *Fr. Epic.*, p. 161. *B. & Br. Ann. N. H.*, No. 681., t. 9, fig. 1, which Mr. Berkeley informs me is not *A. mesodactylus*, as stated in the text.
- „ DURUS. Bolt. King's Lynn.
- „ PRÆCOX. P. Common, June and July.
- „ RADICOSUS. Bull. Not uncommon. Mr. Amyot also finds it near Diss.
- „ PUDICUS. Bull. On an elder stump, North Wootton.
- „ SQUARROSUS. Müll. Usually found on ash.
- „ SPECTABILIS. Fr. On fir stumps.
- „ MUTABILIS. Schæff. North Wootton.
- „ MARGINATUS. Batsch. Common.

- AGARICUS MYCENOIDES. Fr. In a mossy hollow, Rising Heath.
- „ FASTIBILIS. Fr. Common.
- „ FLOCCULENTUS. Poll. Not uncommon.
- „ SCABER. Müll. Common.
- „ OBSCURUS. P. Ringstead Downs.
- „ RIMOSUS. Bull. Everywhere.
- „ GEOPHYLLUS. Sow. Ringstead. Rising.
- „ CONISSANS. Fr. Reffley, and elsewhere on osier stumps.
Fr. Ep., p. 187.
- „ CARBONARIUS. Fr. Bawsey. Sept. 1872.
- „ RUBI. Berk. North Wootton, on the bramble bands
of an old straw beehive.
- „ CUCUMIS. P. Not common. Nov. 1870. “Costes-
sey near Norwich:” *Sowerby*.
- „ SEMIORBICULARIS. Bull. Everywhere.
- „ MELINOIDES. Fr. Not very common.
- „ ERINACEUS. Fr. On dead willow. Castle Rising.
- „ TENER. Schœff. Very common.
- „ HYPNORUM. Batsch. Abundant.
- „ FURFURACEUS. P. Everywhere.
- „ ARVENSIS. Schœff. Much more abundant than *A.*
campestris. The younger plants change to
yellow when cut or bruised.
- „ CAMPESTRIS. L. Common all over the country.
- „ „ var. RUFESCENS. This well marked variety
occurs occasionally around Lynn.
- „ ÆRUGINOSUS. Curt. Common.
- „ INUNCTUS. Fr. Lynn Hospital road, 1871. Ring-
stead Downs, abundantly Oct. 1872. *Fr.*
Ep., p. 219. *Saunders & Smith*, t. 29,
f. 67.
- „ OBTURATUS. Fr. Not rare. *S. & Sm.*, 25, f. 1. *Fries*,
however, seems to consider the plant figured
by *S. & S.* to be *A. phaeospermus*.
- „ MERDARIUS. Fr. Not uncommon. *Fr. Ep.*, p. 220.
S. & Sm. 25, lower figures.
- „ SEMIGLOBATUS. Batsch. Common.
- „ SUBLATERITIUS. Fr. Not very common.
- „ CAPNOIDES. Fr. North Wootton.

- AGARICUS FASCICULARIS. Hud. This is by far the most common agaric in West Norfolk. Mr. Amyot and Mr. Trimmer also find it.
- „ LACRYMABUNDUS. Fr. Reffley Wood.
- „ VELUTINUS. P. South Wootton.
- „ APPENDICULATUS. Bull. Not uncommon.
- „ SEMILANCEATUS. Fr. North Wootton.
- „ SPADICEUS. Schœff. Common.
- „ FŒNISECII. P. Very common.
- „ CORRUGIS. P. February, 1872. Castle Rising.
- „ SEPARATUS. L. Common.
- „ FIMIPUTRIS. Bull. Very common.
- „ GRACILIS. Fr. Common in old hedges. Autumn.
- „ ATOMATUS. Fr. Common.
- „ DISSEMINATUS. P. Very common.
- COPRINUS COMATUS. Fr. This plant is not abundant in West Norfolk. Messrs. Amyot and Norgate find it.
- „ ATRAMENTARIUS. Fr. Very common in spring and autumn.
- „ NIVEUS. Fr. Common.
- „ MICACEUS. Fr. Common.
- „ * RADIANS. Fr. This species was sent by the Rev. R. B. Francis, of Holt, to Sowerby, who, however, mistook its character so much as to figure it as a Lycoperdon, under the name of *L. radiatum*. This affords an instance of the extreme accuracy of Sowerby's delineations, for although he regarded the plant in question as a minute puff-ball, yet a close inspection of the bottom figure of the plate, (t. 145,) shows it to be obviously the representation of an unexpanded agaric. This I believe was first pointed out by M. Desmazières.
- „ LAGOPUS. Fr. On dung. Stem rooting. North Wootton.
- „ PLICATILIS. Fr. Common.
- BOLBITIUS FRAGILIS. Fr. North Wootton.
- „ TITUBANS. Fr. Ringstead.
- CORTINARIUS COLLINITUS. Fr. Rising Heath.
- „ CAMPHORATUS. Fr. Folly Wood, Rising.
- „ PHOLIDEUS. Fr. North Wootton.

- CORTINARIUS ANOMALUS. Fr. Common.
- „ CINNAMOMEUS. Fr. Common.
- „ *BULBOSUS. Fr. Earlham. *Sowerby*.
- „ CASTANEUS. Fr. Common.
- LEPISTA NUDA. Bull. A specimen found on Rising heath, measured 7 inches across the pileus.
- „ PERSONATA. Fr. Common in autumn, growing in the same rings as *A. gambosus* occupied in the spring. It is called locally "Blue legs."
- PAXILLUS INVOLUTUS. Fr. Very Common.
- „ ATRO-TOMENTOSUS. Fr. On fir stumps. Rising, NARBOROUGH, and Ringstead.
- „ PANUOIDES. Fr. Mr. Frank Norgate sent a well grown specimen of this fungus, which was found on sawdust in a cellar at Cawston Rectory.
- HYGROPHORUS HYPOTHEJUS. Fr. Common. In old plants the flesh becomes orange, especially towards the margin. Rev. K. Trimmer finds it at Swannington. "Sir William Jerningham's plantations at Cossey near Norwich, Oct. 1794." *Sowerby*.
- „ OLIVACEO-ALBUS. Fr. Jex's Wood, North Wootton.
- „ PRATENSIS. Fr. Very common.
- „ VIRGINEUS. Fr. Common.
- „ NIVEUS. Fr. Common.
- „ CERACEUS. Fr. Common.
- „ COCCINEUS. Fr. Common.
- „ MINIATUS. Fr. Frequent on damp heaths.
- „ PUNICEUS. Fr. Edgefield Heath, July, 1857, K.T.
- „ CONICUS. Fr. Everywhere.
- „ PSITTACINUS. Fr. Common.
- „ UNGUINOSUS. Fr. North Wootton.
- „ MURINACEUS. Fr. North Wootton.
- GOMPHIDIUS GLUTINOSUS. Fr. Very common.
- „ „ var. ROSEUS. North Wootton Heath.
- „ VISCIDUS. Fr. Common.
- LACTARIUS TORMINOSUS. Fr. Sometimes in company with *L. deliciosus*, with which old examples are easily confounded, unless the specimen be gathered. Rev. K. Trimmer also finds it at Westwick.

- LACTARIUS TURPIS. Fr. Exceedingly common.
- „ BLENNIUS. Fr. Common.
- „ VELLERBUS. Fr. var. EXSUCCUS. Otto. Narborough.
- „ DELICIOSUS. Fr. In several localities in West Norfolk.
Salhouse. Rev. K. Trimmer. The Rev.
R. B. Francis sent this plant to *Sowerby* from
Holt.
- „ RUFUS. Fr. Very common.
- „ GLYCIOSMUS. Fr. Very variable in size
- „ SERIFLUUS. Fr. Common.
- „ *SUBDULCIS. Fr. West Norfolk. Rev. G. Munford.
- RUSSULA NIGRICANS. Fr. Common.
- „ VIRESCENS. Fr. Rackheath. Rising.
- „ RUBRA. Fr. Shottesham, North Wootton.
- „ SARDONIA. Fr. Castle Rising.
- „ HETEROPHYLLA. Fr. South Wootton, Shimpling,
T.E.A.
- „ EMETICA. Fr. Black Hills Wood, Rising.
- „ FRAGILIS. Fr. Common.
- „ ALUTACEA. Fr. In a wood, Gunton, K.T. North
Wootton.
- CANTHARELLUS CIBARIUS. Fr. In Fir plantations, Felthorpe,
Framingham Earl, K.T. Hockeringham
Wood, F.N.
- „ AURANTIACUS. Fr. Very common in West Norfolk,
Felthorpe, K.T.
- „ TUBÆFORMIS. Fr. In a shady lane Little Plumstead,
1853, K.T.
- MARASMIUS PERONATUS. Fr. Common. Ditchingham. *Sowerby*.
- „ OREADES. Fr. Common.
- „ IMPUDICUS. Fr. Rising Heath.
- „ RAMEALIS. Fr. Rising.
- „ ROTULA. Fr. Very common.
- „ GRAMINUM. B. & Br. Common.
- „ EPIPHYLLUS. Fr. Common.
- LENTINUS LEPIDEUS. Fr. Var. MONSTROSUS. On a beam in a cart
shed at Shelton, June, 1840, K.T.
- „ VULPINUS. Fr. On a very rotten stump, Ringstead.
- PANUS STYPTICUS. Fr. Common.

**XEROTUS DEGENER.* Fr. This species was found by the Rev. Mr. Francis of Holt, in November, 1798, "on heathy ground where turf stacks have stood," since then it has not (to the best of my knowledge) been found in Britain. Fig. 1.



Fig. 1. *XEROTUS DEGENER.* Fr. Reduced.

SCHIZOPHYLLUM COMMUNE. Fr. On a felled tree, Cossey, 1853, and in a similar situation at Arminghall, 1861, K.T. Sowerby's plant was grown on a beer barrel in the Rev. Mr. Watt's cellar. at Ashill.

LENZITES BETULINA. Fr. Cossey. Castle Rising.

„ *SEPIARIA.* Fr. On a door-post, King Street, Norwich, 21st March, 1848, K.T.

Order II. POLYPOREI.

BOLETUS LUTEUS. L. Common.

„ *ELEGANS.* Schum. Castle Rising.

„ *FLAVUS.* L. Edgefield Heath. North Wootton.

„ *LARICINUS.* Berk. Ringstead.

„ *GRANULATUS.* L. Common.

„ *BOVINUS.* L. North Wootton Heath.

„ *PIPERATUS.* Bull. North Wootton.

„ *PARASITICUS.* Bull. North Wootton Heath on *Scleroderma vulgare.* The *Scleroderma* was $4\frac{1}{2}$ in. across and formed the matrix for 10 *Boleti.* The largest of these was $3\frac{1}{2}$ in. across the pileus and had a stem 3 in. long and $\frac{3}{4}$ in. thick. The decurrent tubes, formed at the apex of the stem, a zone of parallel raised lines, below which was a pale yellow zone. Below this the outer coat of the stem was cracked into scales, which in the older specimens were revolute, exposing the pale yellow flesh of the stem.

„ *VARIEGATUS.* Fr. North Wootton Heath

- BOLETUS PRUINATUS. Fr. South Wootton. *Fr. Epic* p. 414.
Surely very near *B. chrysenteron*, in company
with which it was growing.
- „ CHRYSENTERON. Fr. South Wootton. Stanninghall.
- „ PACHYPUS. Fr. var. AMARUS. Neatishead. Mr. M.
C. Cooke.
- „ EDULIS. Bull. Common throughout the Country.
- „ SATANUS. Lenz. Gillingham, Stockton, Raveningham.
Dr. Metcalfe.
- „ LURIDUS. Fr. Common.
- „ VERISPELLIS. Fr. Little Carr. North Wootton.
- „ SCABER. Fr. Common.
- „ FELLEUS. Bull. Raveningham. Dr. Metcalfe.
- POLYPORUS RUFESCENS. Fr. Flordon. Reffley Wood.
- „ PERENNIS. Fr. Not very common. Rev. K. Trimmer
has, however, found it several times. Sowerby's
plant came from near Norwich. Bawsey.
- „ SQUAMOSUS. Fr. Common on ash trees.
- „ VARIUS. Fr. Common on willows.
- „ ELEGANS. Fr. var. NUMMULARIUS. On beech sticks.
Castle Rising.
- „ QUERCINUS. Fr. Castle Rising, September, 1871.
- „ INTYBACEUS. Fr. On the border of a field, Great
Melton, October, 1859 and 1870, K.T. In the
hollow of oak tree, South Wootton, 1872.
- „ GIGANTEUS. Fr. Bylaugh. On a stump by the road
side, 1st October, 1871. Mr. Frank Norgate.
- „ SULPHUREUS. Fr. South Wootton.
- „ SALIGNUS. Fr. Intwood. North Wootton.
- „ DESTRUCTOR. Fr. Ringstead.
- „ ADUSTUS. Fr. Common.
- „ AMORPHUS. Fr. East Winch.
- „ HISPIDUS. Fr. Common.
- „ DRYADEUS. Fr. Langley. November, 1852, K.T.
- „ BETULINUS. Fr. Leziate. Wolferton. The Rev. Mr.
Alderson sent this fungus to Sowerby from
Hevingham
- „ PALLESCENS. Fr. On a stump, Saxthorpe, K.T.
- „ APPLANATUS. Fr. Castle Rising.

- POLYPORUS FOMENTARIUS. Fr. On birch, Stratton Strawless, and
on an oak, Thorpe Market, K.T.
- „ IGNIARIUS. Fr. Common.
- „ RIBIS. Fr. Common.
- „ CONCHATUS. Fr. Honing, K.T. North Wootton.
- „ ULMARIUS. Fr. West Winch. Common.
- „ FRAXINEUS. Fr. On an ash tree, Buxton, K.T.
- „ ANNOSUS. Fr. Common.
- „ VELUTINUS. Fr. Wramplingham, K.T. Rising.
- „ VERSICOLOR. Fr. Everywhere.
- „ ABIETINUS. Fr. Whitlingham, K.T., Rising.
- „ FERRUGINOSUS. Fr. Common.
- „ INCARNATUS. Fr. Castle Rising, on the under-side of
dead fir branches before they fall from the
trees.
- „ MEDULLA-PANIS. Fr. On decayed wood, Arminghall;
on a rotten branch, Hapton, K.T.
- „ VULGARIS. Fr. On a decayed post, Hickling,
K.T.
- „ SANGUINOLENTUS. Fr. Not uncommon.
- „ VAPORARIUS. Fr. Everywhere.
- „ FARINELLUS. Fr. East Winch.
- „ HYBRIDUS. B. & Br. North Wootton.
- TRAMETES SUAVEOLENS. Fr. On willow, Horsford, 1860; Had-
discoe, October, 1864, K.T.
- „ GIBBOSA. Fr. Wymondham, Mrs. T. J. Hussey.
- DEDALEA QUERCINA. P. Common.
- „ UNICOLOR. Fr. On a stump, Fundenhall, K.T.
- MERULIUS CORIUM. Fr. Common.
- „ *LACRYMANS. Fr. Norwich, Lynn.
- FISTULINA HEPATICA. Fr. Common on oak. Rev. K. Trimmer has
found it on a walnut tree at Bramerton, and on
a beech tree at Shottesham.

* MERULIUS PULVERULENTUS. Fr. On a moist white-washed wall in an
out-house, Norwich, October, 1860, K.T. This plant is included in the
Eng. Flora, but Mr. Berkeley seems now to doubt its distinctness from
THELEPHORA ARIDA. Fr. In the absence of specimens it is inserted
here.

Order III. HYDNEI.

- HYDNUM IMBRICATUM. L. In fir plantations, Cossey; and Felthorpe, October 1861, K.T.
- „ REPANDUM. L. In woods, Sprowston, Wolterton, and Cossey, K.T.
- „ *COMPACTUM. Fr. “Earsham Wood, Mr. Woodward.”
- „ ZONATUM. Batsch. Framingham Earl, November, 1856; Felthorpe, 11th November, 1857; Intwood, November, 1857; Rev. Kirby Trimmer.
- „ AURISCALPIUM. L. Common.
- „ CORALLOIDES. Scop. On a fir tree, Hemblington, November 1862, K.T.; Wereham, Rev. Mr. Forby. *Sowerby*.
- „ FERRUGINOSUM. Fr. North Wootton.
- „ ALUTACEUM. Fr. Castle Rising.
- „ UDUM. Fr. North Wootton.
- RADULUM ORBICULARE. Fr. Castle Rising.
- GRANDINIA GRANULOSA. Fr. North Wootton.

Order IV. AURICULARINI.

- CRATERELLUS CORNUCOPIOIDES. Fr. In a wood, Bunwell, K.T.
- THELEPHORA CARYOPHYLLEA. Fr. Ringstead Downs. The specimens found there are figured in *Saund. & Sm.* t 41.
- „ PALMATA. Fr. In a wood, Bunwell, November, 1859, K.T.
- „ LACINIATA. P. Everywhere.
- „ BYSSOIDES. P. On the ground on spruce fir leaves, Stratton Strawless, Eceles, Felthorpe, Wymondham, K.T.
- „ PUTEANA. Schum. Common.
- STEREUM PURPUREUM. Fr. Common.
- „ HIRSUTUM. Fr. Common.
- „ SPADICEUM. Fr. Common.
- „ SANGUINOLENTUM. Fr. Common.
- „ RUGOSUM. Fr. Common.
- „ ACERINUM. Fr. Langley, K.T.

- HYMENOCHÆTE RUBIGINOSA. Lev. Common.
 ,, TABACINA. Lev. Gunton, on hazel, November,
 1843, K.T.
 ,, CORRUGATA. Berk. Castle Rising.
 AURICULARIA MESENERICA. Bull. Not uncommon.
 CORTICIUM GIGANTEUM. Fr. North Wootton.
 ,, LACTEUM. Fr. North Wootton, on beech.
 ,, LÆVE. Fr. Everywhere.
 ,, CÆRULEUM. Fr. Norwich, K.T.
 ,, OCHRACEUM. Fr. Pulham, K.T.
 ,, QUERCINUM. P. Common, on oak branches but not
 confined to them.
 ,, CINEREUM. Fr. Common.
 ,, INCARNATUM. Fr. North Runcton.
 ,, NUDUM. Fr. Castle Rising.
 ,, COMEDENS. Fr. Common.
 ,, SAMBUCCI. P. Common.
 CYPHELLA GALEATA. Fr. On moss on the Dones, Great
 Yarmouth, K.T., on moss on North
 Wootton Church wall, 16th November, 1870.
 ,, CAPULA. Fr. North Wootton, Neatishead.
 ,, CURREYI. Berk. Neatishead, M.C.C.
 SOLENIA OCHRACEA. Hoffm. On beech sticks, North Wootton
 and Castle Rising, abundantly.

Order V. CLAVARIEI.

- SPARASSIS CRISPA. Fr. Didlington.
 Admiral Mitford. Fig. 2.
 CLAVARIA AMETHYSTINA. Bull. Amongst
 fallen leaves, Rackheath, Novem-
 ber, 1852, K.T.
 CLAVARIA FASTIGIATA. D.C. Common.
 CLAVARIA MUSCOIDES. L. In grassy
 places, Taverham, Dickleburgh, K.T.
 CLAVARIA CORALLOIDES. L. On the
 ground in shady places, Sprowston,
 Hemblington, Little Plumstead,
 Thorpe Hamlet, K.T.



Fig. 2. SPARASSIS CRISPA. Fr.
 Reduced.

- CLAVARIA CINEREA. Bull. North Wootton Heath.
 ,, CRISTATA. Holmsk. On the ground in shady places,
 Cossey, 20th November, 1857. In a wood at
 Sprowston. November, 1863, K.T.
 ,, RUGOSA. Bull. Common.
 ,, ABIETINA. Sehum. Common.
 ,, GRISEA. P. Framingham Pigot, South Walsham, K.T.
 ,, STRICTA. P. Little Plumstead, Sprowston, Ringstead,
 North Wootton.
 ,, CRISPULA. Fr. At the foot of an old ash tree, North
 Wootton, October, 1870.
 ,, FUSIFORMIS. Sow. Mousehold Heath, Great Witching-
 ham, K.T.
 ,, INEQUALIS. Müll. Common.
 ,, ARGILLACEA. Fr. North Wootton Heath, November.
 ,, VERMICULATA. Seop. Common.
 ,, UNCIALIS. Grev. Not uncommon.
 CALOCERA VISCOSA. Fr. Castle Rising.
 ,, CORNEA. Fr. Whitlingham. Ringstead.
 TYPHULA ERYTHROPUS. Fr. North Wootton.
 ,, GYRANS. Fr. The Resary, Thorpe, K.T.
 PISTILLARIA QUISQUILARIS. Fr. Common.

Order VI. TREMELLINI.

- TREMELLA FOLIACEA. P. Cossey. Reffley Wood. Lakenham, Mr. Crow.
 ,, MESENERICA. Retz. Very common.
 ,, ALBIDA. Huds. Very common.
 ,, TORTA. Willd. Common.
 EXIDIA RECISA. Fr. On willows, Castle Rising.
 ,, GLANDULOSA. Fr. On beech and oak branches.
 HIRNEOLA AURICULA-JUDÆ. Berk. Common on elder stumps.
 NEMATIELIA VIRESCENS. Corda. Very common.
 DACRYMYCES DELIQUESCENS. Dub. Ringstead.
 ,, STILLATUS. Nees. Everywhere.

Fam. II. GASTEROMYCETES. Order VII. HYPOGLEI.

- MELANOGASTER AMBIGUUS. Tul. Under a fir tree in the Black
 Hills Plantation, Castle Rising.

Order VIII. PHALLOIDEL.

PHALLUS IMPUDICUS. Linn. Common. "Norwich." *Sowerby*.
 ,, IOSMOS. Berk. On sandhills by Caistor rails, September,
 1857, Rev. Kirby Trimmer, Yarmouth,
 M.C.C.

CYNOPHALLUS CANINUS. Fr. Not uncommon.

CLATHRUS CANCELLATUS. Linn: Mintlyn Wood, near King's
 Lynn, 20th October, 1859. Miss J. A. Rabett.
 On a bank covered by moss and Pteris. I am
 indebted to Mr. W. Marshall, of Ely, for
 bringing this interesting addition to our fungus
 flora under my notice.

Order IX. TRICHOGASTRES.

*BATARREA PHALLOIDES. P. Norfolk has attained a certain
 notoriety amongst mycologists for its Tricho-
 gasters, foremost amongst which ranks this
 species. It has been found near Norwich by
 Mr. W. Humphrey, and, according to Sowerby,
 by Mr. Woodward: also at Stoke, by Sir W.
 J. Hooker. For several years it did not occur
 in Britain, excepting once at Dropmore, and
 once at Wickham, near Croydon. Towards
 the close of 1872, however, Cecil H. S. Perce-
 val, Esq., found four specimens: "outside and
 inside a decayed ash tree," in the grounds of
 the Earl of Egmont, at Epsom. One of these
 specimens is depicted at fig. 3. p. 67. It is
 highly desirable that Norfolk botanists should
 remember this plant during their autumnal
 rambles.

TULOSTOMA MAMMOSUM. Fr. On an old wall, St. Faith's Lane,
 Norwich, 22nd March, 1848, 31st July, 1855.
 K.T. Mr. M. C. Cooke has also found
 it in the same place. New Catton, 1860—64,
 K.T. Dr. Sutton sent this plant to Sowerby
 from Norfolk. Fig. 4 p. 46.

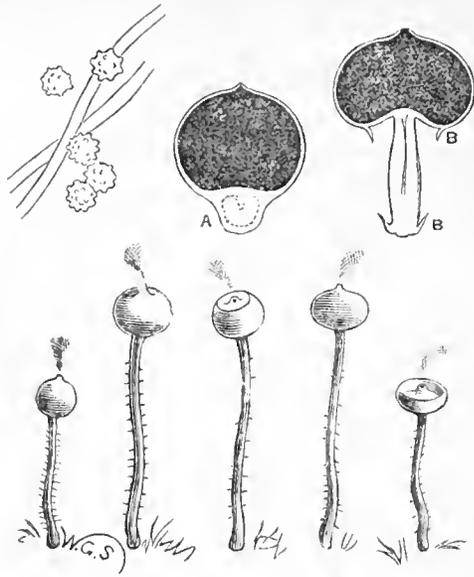


Fig. 4. *TULOSTOMA MAMMOSUM*. Fr. Half natural size. Sections through peridium real size. Fruit enlarged 700 diameters. A, A young plant. B B Veil.

- **GEASTER COLIFORMIS*. P. This remarkable Geaster was found by Messrs. Stone and Woodward, at Gillingham and Earsham, about the end of the last century. Fig. 5, p. 69.
- „ *FORNICATUS*. Fr. Plentiful on a shady hedge bank, Billingford, near North Elmham, 1872, K.T. Sowerby says it is “frequently found in Norfolk and Suffolk.” Fig. 6, p. 69.
- „ *STRIATUS*. D.C. On the sand hills, Winterton, shady places about Caistor, Great Yarmouth, 1861, K.T. Fig. 7, p. 71.
- „ *BRYANTII*. Berk. East Carlton, 1849 and 1867, K.T., North Wootton marshes. The inner peridium in my specimens is flattened at the top. Fig. 8, p. 71.
- „ *LIMBATUS*. Fr. Attlebridge and Skeyton, K. T. Fig. 9, p. 73.
- „ *FIMBRIATUS*. Fr. Castle Rising, under fir trees. Fig. 10, p. 73.
- „ *MAMMOSUS*. Chev. On a hedge bank, Crostwick, 1861, Rev. K. Trimmer. “Woods and heaths, Norfolk. Messrs. Bryan and Woodward.” Fig. 11, p. 75.

- GEASTER RUFESCENS. Fr. "Very plentiful in Major Money's plantations at Trowse, near Norwich, in October, 1794," *Sowerby*. Drayton, Hellesden, Earlham, Rev. Kirby Trimmer. North Wootton Heath, 1871, a small variety. Sparham, F.N. Mr. Trimmer has found the var. *DUPLICATUS*, Chev., *Eng. Fl.*, p. 302, on a hedge bank near the Rectory, Drayton, October, 1861. Fig. 12, p. 75.
- „ *HYGROMETRICUS*. P. "On a sandy bank, Rackheath, one specimen only, October, 1863, very rare." Rev. K. Trimmer. Fig. 13, p. 77.
- BOVISTA NIGRESCENS. P. Common.
- „ *PLUMBEA*. P. Very common.
- LYCOPERDON GIGANTEUM. Batsch. This plant is not of very common occurrence, although a season never passes without some examples being met with. When mature, it is used as a hæmostatic, and is an invaluable remedy for preventing the healing of wounds by first intention. Popularly it is known as a "bulver," "bull-fist," or "fuzz-ball." I have never heard a native of Norfolk apply the term "puff ball" to any Lycoperdon, nor, indeed, is the expression, "toad stool," ever used in West Norfolk (at any rate) to distinguish a fungus, they are always spoken of as "toad skeps."
- „ *CÆLATUM*. Fr. Common.
- „ *PUSILLUM*. Fr. Sandringham Heath, Neatishead.
- „ *SACCATUM*. Vahl. North Wootton Heath. I have never been able to see the echinulate spores.
- „ *GEMMATUM*. Fr. Common.
- „ *PYRIFORME*. Schœff. Common.
- SCLERODERMA VULGARE. Fr. Common.
- „ *BOVISTA*. Fr. Castle Rising.
- „ *VERRUCOSUM*. P. Trowse, Arminghall, Swardeston, K.T.

Order X. MYXOGASTRES.

- LYCOGALA EPIDENDRUM. Fr. King's Lynn.

- RETICULARIA UMBRINA. Fr. Common.
- ÆTHALIUM SEPTICUM. Fr. Common.
- SPUMARIA ALBA. D.C. Very common. Mr. Trimmer has also found at Earham the var. β of *Eng Flora*.
- PTYCHOGASTER ALBUS. Corda. Castle Rising. I cannot see why Fries should look upon this as a degeneration of *Polyporus destructor*. It consists of concentric layers, the more internal of which are dry and dusty, while the exterior are soft and moist. Unless I am greatly mistaken, this fungus grows by the development of fresh material from without; in other words, I look upon the "fleshy peridium" as simply immature parenchyma.
- DIDERMA VERNICOSUM. P. Common.
- „ GLOBOSUM. Fr. On dead oak leaves, Bixley, K.T.
- DIDYMIUM HEMISPHERICUM. Fr. On leaves, Felthorpe, K.T.
- „ CONGESTUM. B. & Br. On a rotten oak branch, North Wootton, February, 1872.
- PHYSARUM NUTANS. P. Very common.
- „ var. γ AUREUM. North Wootton.
- „ ALBUM. Fr. Common.
- BADHAMIA HYALINA. Berk. On a stump, Spixworth, K.T.
- CRATERIUM MINUTUM. Fr. Common.
- „ LEUCOCEPHALUM. Ditm. On leaves, Bracon-Asli, K.T.
- STEMONITIS FUSCA. Roth. Common.
- „ TYPHOIDES. D.C. Reffley Wood.
- „ OVATA. P. Strumpshaw, K.T.
- „ OBTUSATA. Fr. Common.
- DICTYDIUM UMBILICATUM. Sehrad. North Wootton.
- ARCYRIA PUNICEA. P. Common. Sometimes growing on old *Polypori*.
- „ NUTANS. Fr. On a rotten willow almost covering it, Reffley Wood.
- TRICHIA CLAVATA. P. Common.
- „ TURBINATA. With. Common in spring.
- „ CHRYSOSPERMA. D.C. Not uncommon.
- PERICILENA POPULINA. Fr. On fallen poplars, Cossey, Arminghall, K.T.

- PERICHÆNA PICEA. B. & Br. King's Lynn. On rotten wood
and dead herbaceous stems.
LICEA FRAGIFORMIS. Fr. Castle Rising. Dr. Lowe.

Order XI. NIDULARIACEI.

- CYATHUS STRIATUS. Hoffm. Little Plumstead, Tunstead, Yelverton, K.T.
,, VERNICOSUS D.C. Common.
CRUCIBULUM VULGARE. Tul. Common. Norwich, Mr. Pitchford.
Sowerby.
SPHÆROBOLUS STELLATUS. Tode. Beeston St. Andrew's, 1846
and 1850. North Wootton.

Fam. III. CONIOMYCETES. Order XII. SPHÆRONEMEI.

- LEPTOSTROMA FILICINUM. Fr. Common.
,, JUNCINUM. Fr. Horning. M.C.C.
,, SPIRÆÆ. Fr. Irstead.
PHOMA CONCENTRICUM. Desm. King's Lynn.
,, HEDERÆ. Desm. Reffley Wood.
,, LINGAM. Desm. North Wootton.
,, DEPRESSUM. B. & Br. North Wootton.
,, SAMARORUM. Desm. Everywhere.
,, NEBULOSUM. Berk. Neatishead.
LEPTOTHYRIUM JUGLANDIS. Lib. Neatishead.
,, RIBIS. Lib. Neatishead.
ACTINOTHYRIUM GRAMINIS. Kze. Common.
SPHEROPSIS TAXI. Berk. Common.
,, ALISMATIS. Curt. Irstead.
DOTHIORA SPILEROIDES. Fr. Common. Spores frequently uniseptate.
ACROSPERMUM COMPRESSUM. Tode. Common.
,, GRAMINUM. Lib. Ringstead
DIPLODIA CÆSPITOSA. B. & Br. On ivy, North Wootton.
,, ILICICOLA. Desm. Castle Rising.
,, OOSPORÆ. Berk. King's Lynn.
HENDERSONIA ROSÆ. West. Neatishead.
,, SARMENTORUM. West. North Wootton.
DARLUCA FILUM. Cast. Irstead.
,, TYPHOIDEARUM. B. & Br. On grass.

- MELASMA ALNEA. Lev. Common.
 SEPTORIA DIANTHI. Desm. Neatishead.
 „ GRAMINUM. Desm. Roydon, near Lynn. Dr. Lowe.
 „ HEDERÆ. Desm. Common.
 DINEMASPORIUM GRAMINUM. Lev. Hasborough, M.C.C. North
 Wootton.
 PROSTEMIUM STELLARE. Riess. North Wootton, on beech.
 ASTEROMA ROSÆ. D.C. Common.
 CEUTHOSPORA LAURI. Grev. Neatishead, M.C.C.

Order XIII. MELANCONIEI.

- MELANCONIUM BICOLOR. Nees. Lynn.
 „ SPHEROSPERMUM. Link. King's Lynn.
 STEGONOSPORIUM CELLULOSUM. Corda. Ringstead.
 ASTEROSPORIUM HOFFMANNI. M. & N. On beech, Rising.
 CORYNEUM MACROSPORIUM. Berk. North Wootton.
 NEMASPORA CROCEA. P. Common.

Order XIV. TORULACEI.

- TORULA PULVERACEA. Corda. Common.
 „ HERBARUM. Lk. Very common.
 „ *SPORENDONEMA. B. & Br. Mr. Berkeley in the *English
 Flora* refers, Sow., t. 180, in part to this
 species. "The Rev. Mr. Alderson, of Heving-
 ham," sent some cheese to Sowerby on 1st
 June, 1798, by Mr. Dawson Turner, upon
 which this fungus was growing.
 HELICOSPORIUM VEGETUM. Nees. North Wootton.
 BISPORA MONILIOIDES. Corda. On the cut surface of stumps,
 especially hazel. Common.
 SPORIDESMIUM LEPRARIA. B. & Br. Everywhere.
 CONIOTHECIUM AMENTACEARUM. Corda. Instead, North Wootton.
 „ BETULINUM. Corda. Common.

Order XV. PUCCINIEI.

- PHRAGMIDIUM MUCRONATUM. Link. Common.
 „ BULBOSUM. Schl. Very common.
 TRIPHragMIUM ULMARIÆ. Link. Instead.

- PUCCINIA GRAMINIS. Per. Common.
 „ ARUNDINACEA. Hedw. North Wootton.
 „ STRIOLA. Link. Mr. Cooke found the uredo spores at
 Irstead. North Wootton.
 „ CORONATA. Corda. Lynn, in the Hospital field.
 „ POLYGONORUM. Link. Common.
 „ PRIMULÆ. Grev. Beeston, M.C.C.
 „ MENTHÆ. Pers. Norwich, Reffley.
 „ SCORODONIÆ. Link. Irstead, Reffley Wood.
 „ COMPOSITARUM. Schl. On Lapsana and Taraxacum,
 King's Lynn.
 „ DISCOIDEARUM. Link. Var. TANACETI. Irstead. Cooke
 Exs., No. 437.
 „ SYNGENESIARUM. Link. Reffley Wood.
 „ GLOMERATA. Grev. North Wootton.
 „ GALIORUM. Link. North Wootton.
 „ UMBELLIFERARUM. D.C. North Wootton.
 „ APII. Corda. On the leaves of the wild celeri (Apium
 graveolens, L.) abundantly. King's Lynn.
 „ BULLARIA. Link. Ditchingham, M.C.C.
 „ ANEMONES. Pers. Wayford, M.C.C. North Wootton.
 „ VIOLARUM. Link. Norwich, Reffley.
 „ LYCHNIDEARUM. Link. Neatishead, North Wootton.
 „ PULVERULENTA. Grev. Common.
 „ PRUNORUM. Link. Common.
 „ FABÆ. Link. Neatishead.
 „ FALLENS. Cooke. King's Lynn.
 GYMNOSPORANGIUM JUNIPERI. Link. North Wootton.
 PODISOMA JUNIPERI. Fr. West Newton. Dr. J. Lowe. Lynn.
 „ SABINÆ. Fr. East Norfolk. Rev. G. Munford. The
 Rev. J. Freeman, of Ashwicken, informs me
 it is such a pest in his garden that it is quite
 a matter of difficulty to get a Savine to grow.

Order XVI. CEOMACEI.

- TILLETIA CARIES. Tul. Common.
 USTILAGO CARBO. Tul. Common.
 „ LONGISSIMA. Tul. North Wootton.

- USTILAGO HYPODYTES. Fr. Very common.
 „ SALVEII. B. & Br. Castle Rising. Spring.
 THECAPHORA HYALINA. Fing. Hunstanton, Dr. John Lowe.
 Heaham. Dr. Lowe has also found this or an
 allied species growing upon the seeds of Con-
 volvulus sepium, at West Winch, near King's
 Lynn.
 UROCYSTIS VIOLÆ. B. & Br. Common.
 „ POMPHOLYGODES. Sehlecht. Neatishead.
 UROMYCES APPENDICULATA. Lev. Neatishead.
 „ APICULOSA. Lev. Neatishead.
 „ CONCENTRICA. Lev. Castle Rising.
 „ GRAMINUM. Cooke. King's Lynn, in the Hospital
 Field, abundantly.
 COLEOSPORIUM TUSSILAGINIS. Lev. Common.
 „ PETASITIS. Lev. Cantley, M.C.C.
 „ CAMPANULÆ. Lev. Ashmanhaugh, M.C.C. North
 Wootton.
 „ SONCHI-ARVENSIS. Lev. Common.
 „ RHINANTHACEARUM. Lev. Irstead.
 MELAMPSORA TREMULÆ. Tul. North Wootton.
 „ POPULINA. Lev. Ringstead.
 „ EUPHORBIÆ. Cast. Everywhere.
 CYSTOPUS CANDIDUS. Lev. Common. Miss Haneock sent this
 plant to Sowerby from near Norwich.
 UREDO POTENTILLARUM. D.C. Irstead. On Agrimonia, Ring-
 stead.
 „ CARYOPHYLLACEARUM. Johnst. North Wootton.
 „ QUERCUS. Brond. Near Bungay, Mr. D. Stoek. Ditch-
 ingham, M.C.C.
 „ CONFLUENS. D.C.
 „ „ var. β ORCHIDIS. Honing, M.C.C.
 TRICHOBASIS BETÆ. Lev. Common.
 „ SUAVEOLENS. Lev. Very common.
 „ HYDROCOTYLES. Cooke. Irstead.
 „ PARNASSIÆ. Cooke. Norfolk, M.C.C.
 LECYTHEA SALICETI. Lev. Common.
 „ VALERIANÆ. Berk. Honing, M.C.C.
 „ LINI. Lev. North Wootton.

Order XVII. ÆCIDIACEÆ.

- RÆSTELIA CANCELLATA. Reb. King's Lynn.
 „ LACERATA. Tul. Ashmanhaugh, M.C.C.
 PERIDERMIIUM PINI. Chev.
 „ var. CORTICOLA. Cooke. Bawsey.
 ÆCIDIIUM LEUCOSPERMUM. D.C. Wayford, M.C.C.
 „ QUADRIFIDUM. D.C. King's Lynn.
 „ EPILOBII. D.C. North Wootton.
 „ TRAGOPOGONIS. Pers. Terrington.
 „ EUPHORBIÆ. Pers. Ashwieken, Dr. Lowe.
 „ BERBERIDIS. Pers. North Wootton.
 „ CRASSUM. P. North Wootton.
 „ „ var. γ PERICLYMENI. D.C. North Wootton,
 abundantly in July, 1871.
 „ RANUNCULACEARUM. D.C. Common.
 „ VALERIANACEARUM. Duby. Dilham, M.C.C.
 „ ASPERIFOLII. Pers. Roydon, near Lynn, Dr. Lowe.
 „ GROSSULARIÆ. D.C. Neatishead.
 „ URTICÆ. D.C. Not very common.
 „ COMPOSITARUM. Mart.
 „ „ var. TUSSILAGINIS. Pers. Terrington.
 „ „ var. JACOBÆÆ. Grev. Bawsey.
 „ „ var. LAPSANI. Purt. Bawsey. Dr. John Lowe.
 „ VIOLÆ. Schum. Neatishead.
 „ MENTHÆ. D.C. On *Mentha viridis*. Framingham
 Pigot, K.T.
 „ PEDICULARIS. Loboseh. Horning, M.C.C.
 „ RUBELLUM. Pers. Common.
 „ ARI. Berk. East Norfolk, Mr. Munford.
 „ ORCHIDEARUM. Fiedl. Dilham, M.C.C.

Fam. IV. HYPHOMYCETES. Order XVIII. ISARIACEÆ.

- ANTHINA FLAMMEA. Fr.. Castle Rising, on the leaves and involu-
 creres of *Castanea vesca*.
 PACHNOCYBE SUBULATA. Berk. Reffley Wood.

Order XIX. STILBACEÆ.

- STILBUM TOMENTOSUM. Schrad. North Wootton.

- STILBUM VULGARE. Tode. Reffley Wood.
 ,, FIMETARIUM. B. and Br. King's Lynn.
 FUSARIUM ROSEUM. Link. North Wootton.
 ÆGERITA CANDIDA. P. Common.

Order XX. DEMATIEI.

- ARTHROBOTRYUM STILBOIDEUM. Ces. (?) M.C.C.
 SPOROBYE BYSSOIDES. Fr. Ashmanhaugh, M.C.C., Reffley.
 STACHYBOTRYA ATRA. Corda. King's Lynn.
 HELMINTHOSPORIUM FOLLICULATUM. Corda. North Wootton.
 ,, MACROCARPUM. Grev. Ringstead.
 ,, ROUSSELIANUM. Mont. Castle Rising.
 MACROSPORIUM CHEIRANTHI. Fr. Neatishead.
 POLYTHRINCIUM TRIFOLII. Kze. Irstead, Lynn.
 CLADOSPORIUM HERBARUM. Link. Norwich.
 SPORODUM CONOPLEOIDES. Corda. North Wootton.

Order XXI. MUCEDINES.

- ASPERGILLUS GLAUCUS. Link. Common.
 ,, NIGER. Van Tieghem. This fungus grew on the bandage applied to a fractured limb in the West Norfolk and Lynn Hospital, which was kept damp by an acetate of lead lotion. Mr. James Renny, to whom I am indebted for the name of the species, informs me that it is described in *Annales des Sciences Naturelles*, 1867, vol. viii, 5th series, p. 240.
 PERONOSPORA INFESTANS. Mont. Common, 1872.
 ,, OBLIQUA. Cooke. Neatishead.
 POLYACTIS CINEREA. Berk. Common.
 PENICILLIUM CRUSTACEUM. Fr. Everywhere.
 ,, var. β COREMIUM. On dung, King's Lynn.
 OIDIUM FULVUM. Link. Common.
 ,, FRUCTIGENUM. Schrad. Neatishead.
 FUSIDIUM GRISEUM. Link. Common.
 ,, FLAVO-VIRENS. Fr. Common.
 SPOROTRICHUM SULPHUREUM. Grev. On an old cork, Norwich, K.T.

- ZYGODESMUS FUSCUS. Corda. On decaying *Peziza acetabulum*,
Castle Rising.
- BOLACOTRICHA GRISEA. B. and Br. On old sacking, King's Lynn,
probably an immature state of some *Chaetomium*.
- MENISPORA CILIATA. Corda. North Wootton.
- BOTRYOSPORIUM PULCHRUM. Corda. Neatishead.

Order XXII. SEPEDONIEI.

- SEPEDONIUM CHRYSOSPERMUM. Link. Common.

Order XXIII. TRICHODERMACEI.

Division II. SPORIDIIFERA.

Fam. V. PHYCOMYCETES. Order XXIV. ANTENNARIEI.

- ZASMIDIUM CELLARE. Fr. Hanging from the roof of a cellar,
Norwich, K.T.

Order XXV. MUCORINI.

- ASCOPHORA MUCEDO. Tode. On bread, Norwich.
- MUCOR CANINUS. P. Common.
- „ FUSIGER. Link. Common.
- „ CLAVATUS. Link. Norwich, K.T.
- PILOBOLUS CRYSTALLINUS. Tode. Common.
- HYDROPHORA STERCOREA. Tode. North Wootton.

Fam. VI. ASCOMYCETES. Order XXVI. ONYGENEI.

- ONYGENA EQUINA. Pers. On the bones and fur of a dead rabbit.
South Wootton Heath.

Order XXVII. PERISPORIACEI.

- PERISPORIUM VULGARE. Corda. King's Lynn, on old sacking,
which had a red tinge where the perithecia
were situated. The sporidia bear some resem-
blance to those of *Sphaeria sporormia*. Cooke.
- SPHÆROTHECA PANNOSA. Lev. North Runcton.
- „ CASTAGNEI. Lev. King's Lynn.
- PHYLLACTINIA GUTTATA. Lev. Beeston, M.C.C.

- UNCINULA BICORNIS. Lev. Common. On maple leaves.
 MICROSPHERIA BERBERIDIS. Lev. Common.
 „ GROSSULARIE. Lev. King's Lynn.
 ERYSIPIHE LAMPROCARPA. Lev. Neatishead.
 „ MARTII. Link. Neatishead, Lynn.
 „ COMMUNIS. Sehl. Common.
 CHÆTOMIUM ELATUM. Kze. Common.
 „ GRISEUM. Cooke. King's Lynn. *Grevillea*, No. 11,
 p. 175.
 EUROTIIUM HERBARIORUM. Link. North Wootton.

Order XXVIII. ELVELLACEI.

- MORCHELLA ESCULENTA. Pers. Rev. K. Trimmer finds this species in several localities. Mr. F. Norgate finds it at Great Witchingham. It occurs every spring in a wood at Castle Rising.
 „ CRASSIPES. Pers. Castle Rising, Spring, 1871.
 „ SEMILIBERA. D.C. Aldeby, K.T., North Wootton.
 HELVELLA CRISPA. Fr. Common. Sowerby says this plant is “found in several parts of Norfolk, especially to the west of Norwich.”
 „ LACUNOSA. Afz. Common.
 „ ELASTICA. Bull. On a grassy bank at Raekheath, 22nd November, 1852, Colney, November, 1860, K.T.
 VERPA DIGITALIFORMIS. Pers. One specimen of this was brought to me from North Wootton, in May, 1871.
 MITRULA CUCULLATA. Fr. Castle Rising. “I found great quantities of this under the close shade of firs on a rising ground in Sir Wm. Jerningham's plantations near Norwich, October, 1794.” *Sowerby*.
 „ PALUDOSA. Fr. North Wootton Heath, 1864, Dr. John Lowe and C.B.P., since which date I have annually searched for it, but unsuccessfully.
 SPATHULARIA FLAVIDA. Pers. Tibbenham, October, 1844, K.T., Ringstead. Sowerby “gathered this fungus in the autumn of 1794, in the plantation, at Costessey, near Norwich.

- LEOTIA LUBRICA. P. Common.
- GEOGLOSSUM GLUTINOSUM. P. Mousehold Heath, October, 1853, K.T.
- „ VISCOSUM. P. Mousehold Heath, 9th October, 1856, Dickleburgh, Postwick, K.T.
- „ GLABRUM. P. Grassy places, Rackheath, Sprowston, Shimpling, K.T.
- „ HIRSUTUM. P. Rackheath, Little Plumstead, Woodbastwick, K.T.
- „ DIFFORME. Fr. Mr. Trimmer has found this species in several places : it grows on Ringstead Downs.
- PEZIZA ACETABULUM. L. Framingham Earl, 29th April, 1859, Sprowston, May, 1861, K.T., Castle Rising.
- „ MACROPUS. P. On the ground amongst fallen leaves, Framingham Earl, 26th November, 1857, K.T.
- „ TUBEROSA. Bull. Beeston St. Andrew, K.T., Great Carr, Castle Rising.
- „ VENOSA. P. Ingham, April, 1864, K.T. Not uncommon around Lynn, but not always with perfect fruit. In the young state the paraphyses are septate : and in this stage the sporidia become visible in the asci, when they are treated with a drop of tincture of iodine, as was pointed out to me by Mr. W. Phillips, of Shrewsbury.
- „ BADIA. P. On a hedge bank, St. Faith's, 15th March, 1861, K.T.
- „ COCHLEATA. Huds. Under beech trees, Weston, May, 1862, K.T.
- „ LEPORINA. Batsch. In a fir wood, Castle Rising.
- „ ONOTICA. P. Sowerby found this fungus "in plenty in Sir William Jerningham's plantation near Norwich." Mr. Trimmer found it on a bank at Little Plumstead, 4th Nov., 1856, and at Cossey, in Sept. 1859.
- „ AURANTIA. Fr. At the foot of a tree, Kirby Bedon, K.T.
- „ REPANDA. Wahl. On the ground in a beech plantation, Easton, Oct. 1855. On rotten branches under beech trees, Colney, 1859, K.T. Ringstead.
- „ VESICULOSA. Bull. Common.

- PEZIZA MICROPUS Pers. On a poplar stump on Castle Rising Heath, February.
- „ ISABELLINA. W. G. Smith. On a stump in the Folly Wood, Castle Rising, April, 1871. *Grevillea* No. 9, p. 136, t. 9.
- „ CUPULARIS. L. On a hedge bank skirting a wood at Taverham, Oct. 1861, K.T. Salhouse, M.C.C.
- „ ARGILLACEA. Sow. "On a plastered wall in an out house, Norwich, Nov. 1866, and Feb. 1867, very rare," Rev. Kirby Trimmer.
- „ RUTILANS. Fr. Lammas, K.T. North Wootton.
- „ MELALOMA. A. & S. Ringstead Downs.
- „ LEUCOLOMA. Reb. On a wall top, Trowse, K.T.
- „ HUMOSA. Fr. On the ground amongst *Polytrichum piliferum*, St. Faith's Newton, K.T.
- „ SCHIZOSPORA. Phillips. Bawseyheath. *Grevillea* No. 9, p. 129.
- „ GRANULATA. Bull. Common.
- „ FURFURACEA. Fr. On alder branches, while still hanging on the trees, South Wootton.
- „ COCCINEA. Jaeg. Bunwell, Cossey, K.T. North Wootton, Wallington. Mr. Trimmer observes, that this species is less frequent in East than in North-west Norfolk.
- „ RADICULATA. Sow. North Wootton, W.G.S.
- „ HEMISPHERICA. Wigg. On the ground in a wood at Beeston, St. Andrew's.
- „ TRECHISPORA. B. & Br. North Wootton.
- „ STERCOREA. P. Common.
- „ VIRGINEA. Batsch. Common.
- „ CALYCINA. Sehum. Common. Var γ on larch bark, Norwich, May 1849, K.T.
- „ BICOLOR. Bull. Ringstead Downs.
- „ CERINA. P. On a beech stump, Felthorpe, K.T.
- „ CORTICALIS. P. On an ash stump, Reffley Wood.
- „ SULPHUREA. P. Common, on old nettle stems.
- „ DOMESTICA. Sow. "On a plastered wet ceiling, at Norwich, 1st October, 1862." Rev. Kirby Trimmer. The Rev. Mr. Alderson found this species on clay walls at Hevingham, and it was from his specimens that Sowerby's figure was taken.

- PEZIZA PRUNORUM. Fekl. North Wootton, on sloe.
- „ FUSCA. Pers. Common.
- „ FIRMA. Pers. Common, mostly on oak.
- „ ECHINOPHILA. Bull. Castle Rising. This species is readily distinguished from *P. firma* by its curved sporidia.
- „ INFLEXA. Bolt. On nettle stems, North Wootton.
- „ CYATHOIDEA. Bull. Very common.
- „ PTERIDIS. A. & S. Castle Rising. *Grevillea* No. 10, p. 115.
- „ VERSICOLOR. Fr. North Wootton.
- „ CINEREA. Batsch. Very common.
- „ SPHERIOIDES. Pers. North Runcton.
- „ ERUMPENS. Grev. On sycamore petioles. Spring. Ringstead.
- „ FLAVEOLA. Cooke. On dead *Pteris* fronds. Jex's Wood. North Wootton. *Grevillea* No. 9, p. 131.
- „ TYPHLÆ. Cooke. North Wootton Heath. *Grevillea* No. 9, p. 131.
- „ PLANTAGINIS. Fekl. King's Lynn. On *Plantago lanceolata* *Grevillea*, No. 9, p. 131.
- „ FUSARIOIDES. Berk. Common.
- „ RESINÆ. Fr. East Winch.
- HELOTIUM ACICULARE. Fr. On a rotten stump in a wood at Gunton, K.T. Rising.
- „ VIRGULTORUM. Fr. Common.
- „ CONIGENUM. Fr. Castle Rising.
- „ CITRINUM. Fr. Common.
- „ PRUINOSUM. Jerd. Frequently met with on various Sphæriacei.
- „ HERBARUM. Fr. On nettle stems, Lynn.
- „ PUNCTATUM. Fr. On a chestnut leaf, Ringstead.
- PATELLARIA ATRATA. Fr. North Wootton.
- „ RHABBARBARINA. Berk. North Runcton.
- „ PROXIMA. B. & Br. On old railings, Lynn.
- „ LIGNYOTA. Fr. Castle Rising.
- TYMPANIS LIGUSTRI. Tul. Irstead.
- CENANGIUM RUBI. Fr. Neatishead.
- ASCOBOLUS FURFURACEUS. P. Common.
- „ CILIATUS. Schm. Irstead.

- BULGARIA INQUINANS. Fr. Framingham Pigot, Cossey, Castle Rising.
 „ SARCOIDES. Fr. Common.
 STICTIS PALLIDA. Pers. On willow, Rising.
 „ VERSICOLOR. Fr.
 „ var. ALBA. Common.
 „ var. VIRIDIS. On willow, Rising.

Order. XXIX. TUBERACEI.

- ELAPHOMYCES VARIEGATUS. Vitt. Stratton Strawless, K.T. Under chestnut trees in a wood at Castle Rising.

Order. XXX. PHACIDIACEI.

- PHACIDIUM CORONATUM. Fr. Not common in West Norfolk.
 „ TRIFOLIUM. Bond. King's Lynn.
 „ RANUNCULI. Desm. North Wootton.
 HETEROSPHERIA PATELLA. Grev. Terrington St. Clement's.
 RHYZISMA ACERINUM. Fr. Very common.
 „ URTICÆ. Fr. Common around Lynn.
 HYSTERIUM PULICARE. Pers. I have never been able to find a specimen in which the sporidia were hyaline at their extremities.
 „ ANGUSTATUM. A & S. Common on sloe.
 „ FRAXINI. P. Common.
 „ CURVATUM. Fr. North Wootton, on bramble.
 „ LINEARE. Fr. On decorticated elm branches, North Wootton.
 „ VIRGULTORUM. D.C. On bramble, Runeton.
 „ PINASTRI. Schrad. Everywhere.
 „ ARUNDINACEUM. Schrad. Eccles, Irstead, Lynn.
 COLPOMA QUERCINUM. Wallr. Common.
 LOPHIUM MYTILINUM. Fr. On an old fir plank, King's Lynn.
 STEGIA ILICIS. Fr. Drayton, K.T.
 TROCHILA CRATERIUM. Fr. North Wootton.

Order. XXXI. SPHERIACEI.

- TORRUBIA ENTOMORRHIZA. Fr. On dead pupæ, Kirby Bedon April, 1854. Plentifully in Blickling Park May, 1856, K.T. In several places in North Wootton in the spring of 1871. "Edgefield. Rev. R. B. Francis."

- TORRUBIA MILITARIS.** Fr. On the pupæ of insects, Mousehold Heath, and at Stratton Strawless, 15th Dec., 1858, K.T. The Conidia, (*Isaria farinosa*) is common enough, but I have never found the ascophore.
- „ **OPIHOGLOSSOIDES.** Tul. In great abundance in a plantation at Stratton Strawless, parasitic on *Elaphomyces variegatus*, 5th October, 1866, from which date up to the close of 1871 it has not reappeared, K.T. Castle Rising.
- „ ***CAPITATA.** Tul. This species was sent to *Sowerby* “by the lady of the Rev. R. Francis, from Holt.”
- CLAVICEPS MICROCEPHALA.** Tul. The “Stroma” is not uncommon on reeds around Lynn.
- EPICHLOE TYPHINA.** Berk. Common.
- HYPOCREA GELATINOSA.** Tul. The green variety is not uncommon on rotten wood.
- „ **RUFA.** Fr. The Conidia, (*Trichoderma viride*), is very common, but I have never met with the ascophore.
- „ ***ALUTACEA.** Fr. “I found three specimens in Sir William Jerningham’s plantations at Costessey, near Norwich, in the year 1783.” *Sowerby*.
- HYPHOMYCES AURANTIUS.** Tul. On *Polyporus versicolor* and *P. salignus*, South Wootton.
- „ **LATERITIUS.** Tul. Castle Rising. Dr. Lowc.
- NECTRIA PULICARIS.** Tul. On elder, not uncommon.
- „ **CINNABARINA.** Fr. Common.
- „ **COCCINEA.** Fr. Norwich, Lynn.
- „ **SINOPICA.** Fr. Refley Wood, on ivy.
- „ **INAURATA.** B. & Br. King’s Lynn. This in the early stage resembles externally *N. sinopica*, in as much as they are both clothed with a yellowish meal, and in both do the perithecia become umbilicated. As the yellow meal disappears, however, the perithecia of *N. sinopica* become of dull red colour, while those of *N. inaurata* assume a blackish appearance.
- „ **SANGUINEA.** Fr. On sticks, Norwich.
- „ **EPISPHERIA.** Fr. Common.

- XYLARIA POLYMORPHA. Grev. Not uncommon.
- „ DIGITATA. Grev. On elder stump, Surlingham, K.T.
- „ HYPOXYLON. Grev. Very common.
- „ CARPOPHILA. Fr. Common.
- PORONIA PUNCTATA. Fr. On horse dung, Caistor, by Yarmouth,
30th September, 1850, K.T.
- HYPOXYLON LUTEUM. Fr. On rotten hazel stumps, staining the
wood yellow, North Wootton, Rising.
- „ CONCENTRICUM. Grev. On decayed wood. Common.
On a birch tree, Ringstead. When young this
plant is of a chocolate brown colour.
- „ COCCINEUM. Bull. Not very common.
- „ MULTIFORME. Fr. Common on birch.
- „ ARGILLACEUM. Fr. On ash, North Wootton.
- „ FUSCUM. Fr. Very common.
- „ RUBIGINOSUM. Fr. Not uncommon on ash.
- „ SERPENS. Fr. On rotten wood, Castle Rising.
- „ UDUM. Fr. North Wootton.
- EUTYPA ACHARII. Tul. Ringstead, Rising.
- „ LATA. Tul. Common.
- „ FLAVO-VIRENS. Tul. Very common.
- „ LEIOPLACA. Fr. North Wootton.
- „ SCABROSA. Fckl. Rising, 1871.
- MELOGRAMMA GASTRINUM. Tul. North Wootton.
- POLYSTIGMA RUBRUM. Pers. North Wootton.
- DOTHIDEA ULMI. Fr. Common.
- „ PODAGRARLE. Fr. Ashmanhaugh, M.C.C.
- „ TRIFOLII. Fr. Spixworth, K.T.
- „ JUNCI. Fr. Irstead, North Wootton.
- „ GRAMINIS. Fr. Common.
- „ RIBESIA. P. Norwich, Lynn.
- „ ROSÆ. Fr. Horstead, Lynn.
- „ FILICINA. Fr. Common. Spores biseptate.
- DIATRYPE QUERCINA. Tul. Common.
- „ VERRUCÆFORMIS. Fr. Irstead, Stratton Strawless.
- „ „ var. TOCCLEANA. De Not. Castle
Rising. *Grevillea* No. 10, p. 155.
- „ STIGMA. Fr. Everywhere.
- „ DISCIFORMIS. Fr. Castle Rising.

- DIATRYPE BULLATA. Fr. Not uncommon.
 ,, PYRRHO CYSTIS. B. & Br. Castle Rising.
 ,, STRUMELLA. Fr. Norwich, Lynn.
 ,, NUCLEATA. Curr. North Wootton.
 ,, BADHAMI. Curr. North Wootton
 ,, FERRUGINEA. Fr. Ringstead.
 ,, FRANGULÆ. P. On elder, Rising.
- MELANCONIS STILBOSTOMA. Tul. King's Lynn.
 ,, ALNI. Tul. Irstead, M.C.C.
 ,, LANCIFORMIS. Tul. North Wootton.
- VALSA PRUNASTRI. Fr. Drayton, K.T. Castle Rising.
 ,, STELLULATA. Fr. Common, on elm.
 ,, SYNGENESIA. Fr. Common.
 ,, DISSEPTA. Fr. Sometimes the sporidia assume quite a
 brown colour.
 ,, DRYINA. Curr. North Wootton.
 ,, CERATOPHORA. Tul. North Wootton.
 ,, ,, var. ROSARUM. Relfley Wood.
 ,, AMBIENS. Fr. Very common.
 ,, SALICINA. Fr. Everywhere.
 ,, PULCHELLA. Fr. Ringstead, North Wootton.
 ,, QUATERNATA. Fr. Common.
 ,, LEIPHEMIA. Fr. Very common.
 ,, TILIÆ. Tul. North Runcton.
 ,, CRATEGI. Curr. North Wootton.
 ,, TALEOLA. Fr. The bark on which this species grows
 becomes infiltrated with a tallow-like substance
 having a peculiar odour.
 ,, THELEBOLA. Fr. Irstead.
 ,, TURGIDA. Fr. Wolterton, K.T.
 ,, FENESTRATA. B. & Br. On alder, King's Lynn.
- CUCURBITULA LABURNI. De Not. North Wootton.
 ,, ELONGATA. Grev. ,,
 ,, ,, var. SIMPLEX. North Wootton.
 ,, SPARTII. De Not. North Wootton.
 ,, MACROSPORA. Tul. North Wootton.
 ,, CUPULARIS. Fr. King's Lynn.
- GIBBERA SAUBINETII. Mont. Common.
 MASSARIA BUFONIA. Tul. Not uncommon.

- LOPHIOSTOMA BICUSPIDATA. Cook. On beech.
- „ ANGUSTILABRA. B. & Br. On willow and on gorse,
North Wootton.
- „ ARUNDINIS. De Not. North Wootton.
- SPHERIA AQUILA. Fr. Very common.
- „ PHEOSTROMA. Mont. On sticks.
- „ RACODIUM. Fr. Cawston, K.T.
- „ TRISTIS. Tode. On rotten wood, North Wootton. The
subiculum is very liable to be overlooked.
- „ HIRSUTA. Fr. Reffley Wood. I am disposed, with
Mr. Currey, to doubt the distinctness of this
species from *S. racodium*.
- „ CANESCENS. Pers. On beech, North Wootton.
- „ MUTABILIS. Pers. On beech, Castle Rising.
- „ PILOSA. Pers. Very minute. Rising.
- „ SPERMOIDES. Hoffm. Common. Sporidia oozing out
and forming little white globules on the
ostiola.
- „ MORIFORMIS. Tode. Ringstead, abundantly on hazel
stumps.
- „ POMIFORMIS. Pers. On birch, Ringstead. North
Wootton.
- „ PULVICULA. Curr. Common.
- „ MAMMÆFORMIS. Pers. Bexley, Halvergate, Horsford,
and Castle Rising.
- „ OBDOCENS. Fr. On decorticated ash sticks, Ringstead
Downs.
- „ PULVIS-PYRIUS. Pers. Common.
- „ SPORORMIA. Cooke. King's Lynn.
- „ STERCORARIA. Sow. Common. I find this species in
perfection, in company with the preceding,
growing upon dung which is washed by the
sea water. In the immature state, the sporidia
are often possessed of a hyaline appendage at
each extremity. Originally found near Yarmouth
by Mr. Dawson Turner, and sent by him to
Sowerby.
- „ MYRIOCARPA. Fr. Not uncommon.
- „ PULVERACEA. Ehr. Common.

- SPHÆRIA PECILOSTOMA. B. and Br. On furze branches at North Wootton. It must not be confounded with *Lophiostoma augustilabra*.
- „ MASTOIDEA. Fr. On ash, Reffley.
- „ LONICERÆ. Sow. Neatishead.
- „ ARUNDINACEA. Sow. North Wootton.
- „ CIRRHOSA. Pers. Castle Rising.
- „ MELANOTES. B. and Br. On palings, and on decorticated branches, not uncommon.
- „ APICULATA. Curr. On rotten wood, King's Lynn.
- „ REFRINGENS. Curr. M.S. North Wootton, on willow.
- „ XYLOSTEL. Pers. North Runcton Common.
- „ DECEDENS. Fr. North Wootton.
- „ SPICULOSA. Pers. Common on ivy.
- „ INQUILINA. Fr. Castle Rising. On ash sticks, Ringstead.
- „ GLIS. B. and Curr. North Wootton.
- „ VIBRATILIS. Fr. North Wootton.
- „ MILLEPUNCTATA. Grev. Common.
- „ QUADRINUCLATA. Curr. On ash branches, perithecia very small. Ringstead.
- „ DITOPA. Fr. Irstead.
- „ CLYPEATA. Nees. North Wootton.
- „ MAMMILLANA. Fr. North Wootton, on oak.
- „ EPIDERMIDIS. Fr. Not uncommon.
- „ LIRELLA. Fr. Irstead.
- „ ACUS. Blox. Neatishead.
- „ HERBARUM. Pers. Very common.
- „ LUNARLE. B. and Br.? A plant was once found on rotten ash, which answered in all other points to this species. Mr. F. Currey, to whom the specimen was submitted, did not consider that difference in the matrix alone was sufficient to deferentiate a species.
- „ RUBELLA. Pers. Lynn, Neatishead.
- „ ACUMINATA. Sow. Common.
- „ HERPOTRICHIA. Fr. North Wootton.
- „ ACUTA. Moug. Very common.
- „ DOLIOLUM. Pers. North Wootton.
- „ AGNITA. Desm. Irstead.

- SPHÆRIA DERASA. B. and Br. Very common.
 „ SABULETORUM. B. and Br. Wolferton, Hunstanton.
 „ ECHINELLA. Cooke. Hasborough, M.C.C.
 „ ROSTELLATA. Fr. North Wootton, North Runcton.
 „ FIMBRIATA. Pers. Mr. D. Stock.
 „ TUBÆFORMIS. Tode. North Wootton.
 „ GNOMON. Tode. Ringstead.
 „ SETACEA. Pers.
 „ „ var. PETIOLÆ. Castle Rising.
 „ „ var. EPIPHYLLÆ. Abundant at Ringstead on
 lime leaves.
- SPHÆRELLA MACULÆFORMIS. Pers. Common.
 „ PUNCTIFORMIS. Pers. Neatishead.
 „ MYRIADEA. D.C. Neatishead.
 „ ERYNGII. Fr. Hasborough.
 „ RUSCI. De Not. North Wootton, Lynn.
 „ ISARIPHORA. De Not. Common.
 „ PTERIDIS. Desm. Neatishead.
 „ RUMICIS. Desm. Neatishead.
- STIGMATEA ROBERTIANI. Fr. Very common.
- ISO THEA PUSTULA. Berk. Neatishead, Reffley.
- DICHÆNA STROBILINA. Fr. The pycnidia are very common.

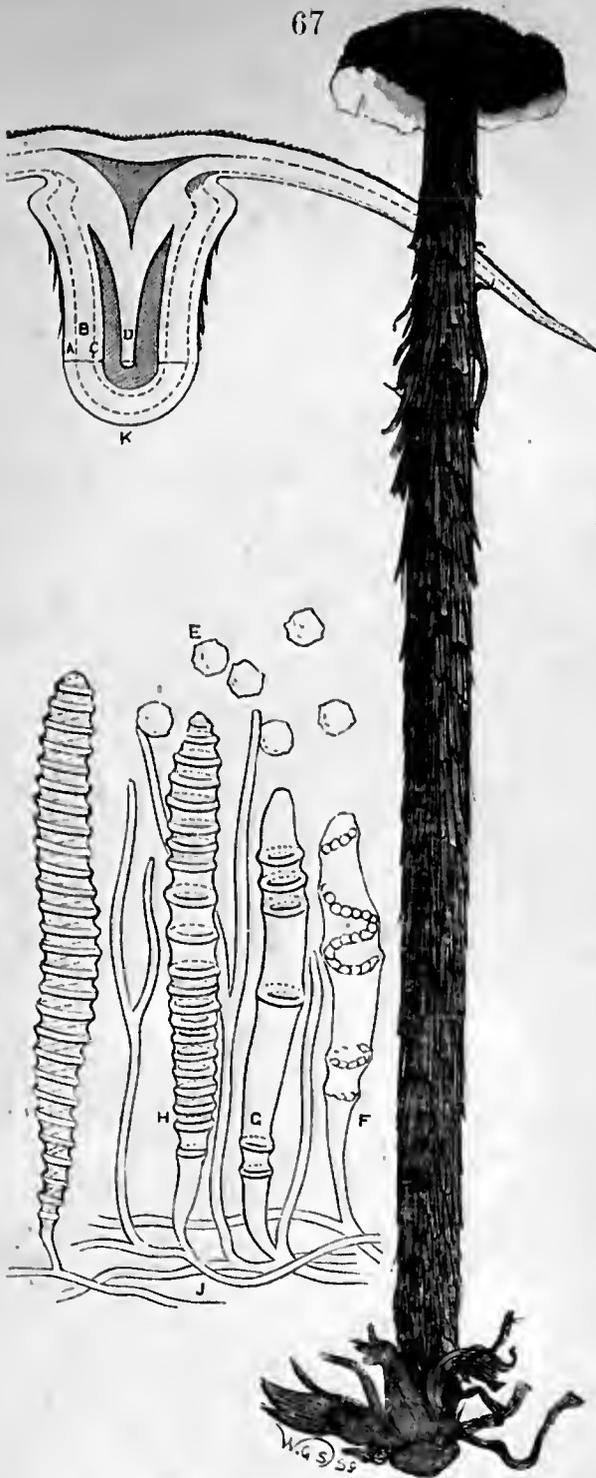


Fig. 3. BATABREA PHALLOIDES. P. Half natural size. Section of receptacle (K) twice real size. Spiral bodies and fruit enlarged 700 diameters.

A Brittle outer bark. B Hard woody stratum. C Lining composed of fine silky threads. D Central pith (which becomes dilated below) composed of extremely fine silky threads. E Spores round or slightly noduloso .0002 in. diameter. F G H I Spiral bodies of capillitium showing how the internal spirals or rings are gradually formed from a differentiation of the contents of the saes, which spring directly from the irregular threads of the capillitium J.



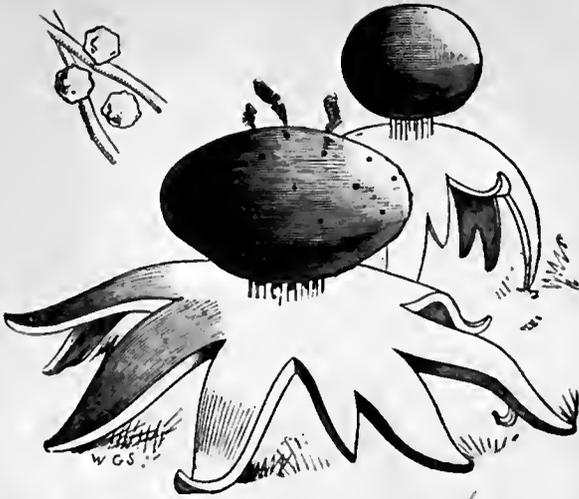


Fig 5. *GEASTER COLIFORMIS*. P.¹

After Sewerby. Half actual size. The spores $\times 700$ diam. are from a specimen in the British Museum.

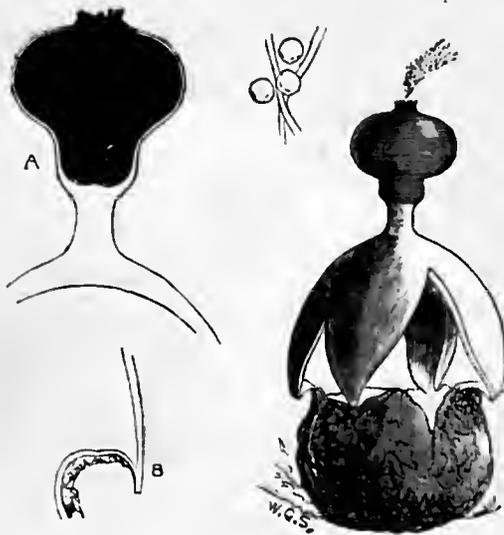


Fig. 6. *GEASTER FORNICATUS*. Fr.

Half actual size; section of inner peridium (A) real size. B represents the tip of a lobe in section showing the connection between the two layers of the outer peridium. Spores $\times 700$ diam.



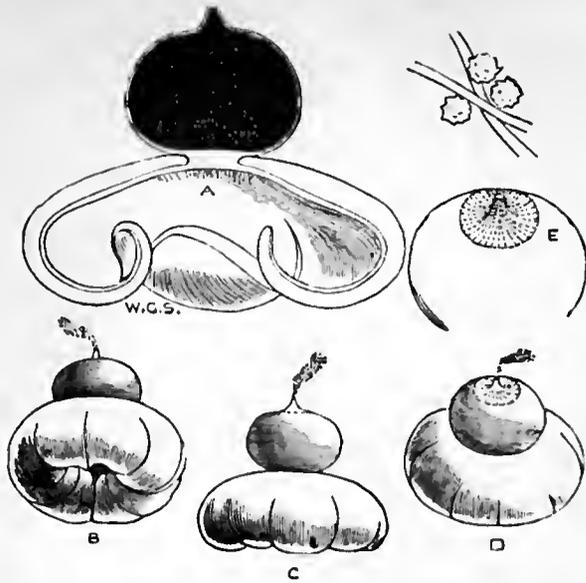


Fig. 7. *GEASTER STRIATUS*. D.C.

B C D three individuals half actual size. Section (A) and mouth (E) real size.
Spores $\times 700$ diam.

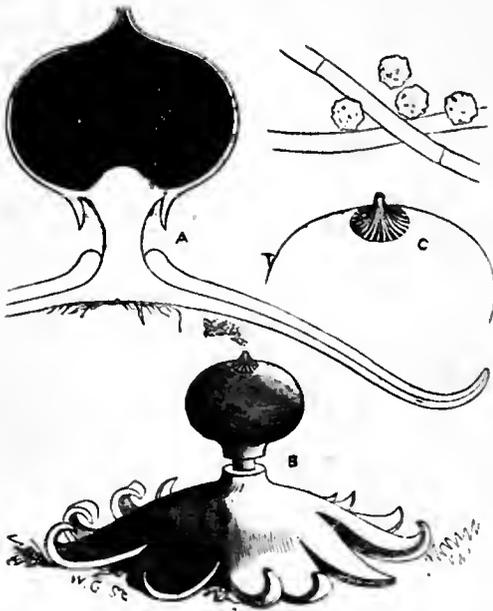


Fig. 8. *GEASTER BRYANTII*. Berk.

Half actual size (B). Section of inner peridium (A) and mouth (C) real size.
Spores $\times 700$ diam.



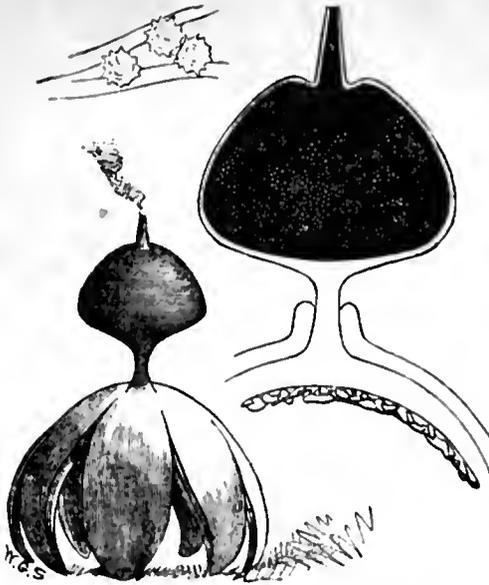


Fig. 9. *GEASTER LIMBATUS*. Fr.

Half actual size. Section of inner peridium real size. Spores $\times 700$ diam.

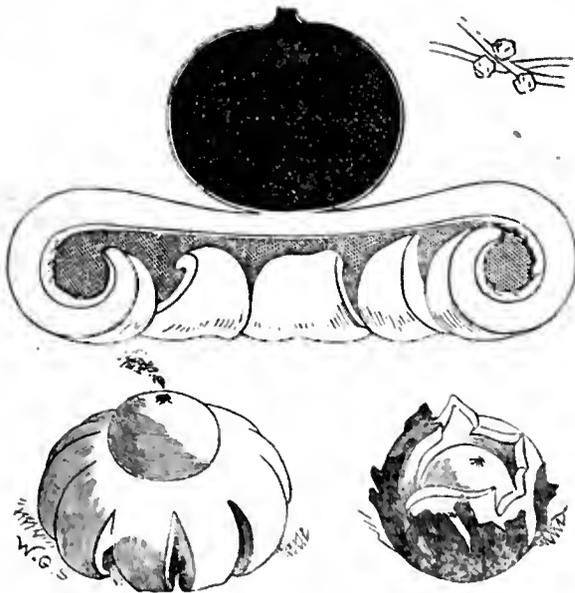


Fig. 10. *GEASTER FIMBRIATUS*. Fr.

Half actual size. Section real size. Spores $\times 700$ diam.





Fig. 11. *GEASTER MAMMOSUS*. Chev.

After Sowerby. Spores $\times 700$ diam. From an authentic specimen in the possession of the Rev. M. J. Berkeley.



Fig. 12. *GEASTER RUFESCENS*. Fr.

Half actual size. Section real size. Spores $\times 700$ diam.



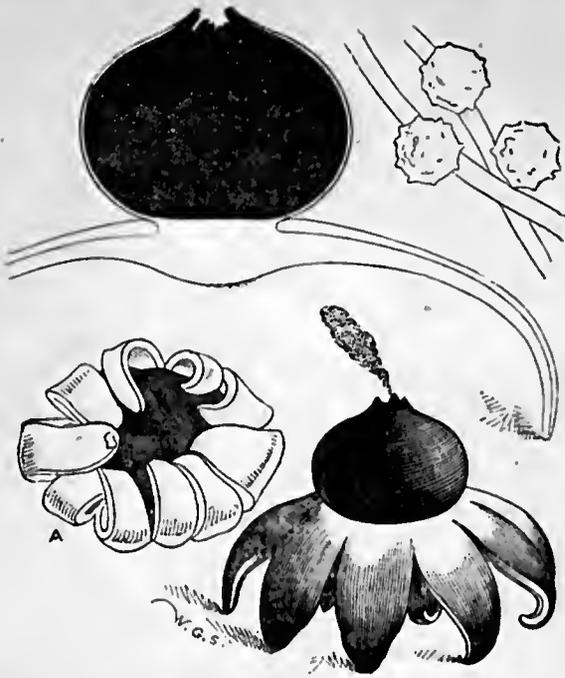


Fig. 13. *GEASTER HYGROMETRICUS*. P.

Half actual size. Section real size. A represents a plant in a dry state.
Spores $\times 700$ diam.



IV.

THE OTTER.

BY THOMAS SOUTHWELL, F.Z.S.

Read 17th December, 1872.

OF the larger indigenous quadrupeds inhabiting Norfolk, the otter has suffered less from the disturbing influences of man than any other. The fox has undergone a succession of persecutions and protections which have exterminated and renewed the race probably more than once. The same in a less degree may be said of the badger, and if one of the latter is now at large in this county it is doubtless either a straggler, or descended from an introduced stock. The otter, however, has survived, although in diminished numbers, partly from the peculiar features of the country which forms its great stronghold, and partly from its not being found in sufficient numbers to render it worthy the attention of the sportsman where otter hunting would be practicable. Although most frequent in East Norfolk, there is scarcely a stream in the county, however small, near which the otter has not been found. In the West Norfolk rivers, Ouse, Wissey, Nar, upper Wensum, and other minor streams, it occurs occasionally; in South-east Norfolk, the Waveney is a favourite resort, but the North-eastern division of the county, watered by the Yare, Bure, and Ant, and interspersed with those remarkable sheets of water known as the "broads," forms its great stronghold. Here in the solitude of the wide spread reed beds which fringe these sluggish streams, or in the "broads" themselves, swarming with fish, the otter finds peace and plenty, and rears its young ones comparatively undisturbed; for so great is its power of concealment, aided by its nocturnal habits—so wary is it, and so difficult of approach its natural haunts, that I am of opinion, strengthened by conversations I have had with men who have spent their lives about the waters, that the number annually killed by the trap or the gun of the

keeper is small, compared with those left, and that this species is far more numerous than is generally supposed.* I can see no excuse for the destruction of the otter in this county, and I never see a dead one without regret; the coarse fish on which they prey (not salmon or trout here) may well be spared them out of the multitudes which throng the "broads," and except on very rare occasions, they commit no farther depredation; surely this species may be spared the fate which it is but too probable has already overtaken (so far as this county is concerned) the only British representative of the *Ursidae*—the badger.

Nothing can be more perfectly adapted than the form of the otter to its mode of life; we are all so well acquainted with the external appearance of the animal—its flattened head, smooth repellent coat, broad webbed feet, and stout powerful tail—that I will not dwell upon this part of the subject; nor is it likely that anyone who has penetrated below the skin, will fail to have noticed the great length of the body in comparison with its bulk, or the short, muscular, loosely articulated fore legs, which, although not adapted for graceful motion on shore, are perfect as paddles, and possessed of the greatest possible freedom of motion; the muscles of the back are also very powerful, and the whole is terminated by such a tail as we shall only find surpassed in the kangaroos. Although the water is the element in which the otter seeks its prey, and may

* The following extracts from a note on "Otter Hunting in Norfolk and Suffolk," contributed to the *Eastern Counties' Collectanea*, by Mr. M. Knights, will convey some idea of the former abundance of otters in the Norfolk rivers:—

"During the sixteenth century the Yare so greatly abounded with them that they were formidable rivals to the fishermen. Accordingly, in some regulations made in 1557 by the 'Norwich Assembly, for the fresh-water fishermen between the tower at Conisford and Hardley Cross,' it was provided:—'that every man shall be bound to keep a dog to hunt the otter, and to make a general hunt twice or thrice in the year or more, at time or times convenient, upon pain to forfeit 10s.'

"In the *Norwich Gazette* of May, 1729, it is stated that—'Mr. Daniel Spalding, of Brockdish, the famous otter hunter, has killed three brace of old otters this journey near this city;' also that Peter Riches, Esq., and five others named, all residents at Palgrave, Suffolk, and 'lovers of the diversion of otter hunting, have between the 18th March and 20th May this season,' killed seventeen brace of otters;" these would probably be killed on the river Waveney, which forms the boundary between the counties of Norfolk and Suffolk.

therefore be said to be most at home, it often travels several miles in its nocturnal expeditions, passing from one stream to another ; they are said always to fish up-stream, returning down-stream to their sleeping places in the morning, and in this manner they pass over considerable distances, sometimes in the water, sometimes running along the banks of the river. Mr. Gurney mentions an instance of one which had thus pursued all the windings of the Yare from Wramplingham to Eaton, its tracks being visible at intervals on the snow-covered banks.

As a rule, the otter lays up during the day, but it is occasionally seen basking in the sunshine, or swimming leisurely across the open water, always, however, on the look out for enemies. When trapped it seems quite subdued, and although under most circumstances very courageous and even fierce, it appears to make very little effort to escape ; the Rev. H. T. Frere told me of one which was taken in a trap set close to the roots of a hollow tree ; when found it had merely retired under the tree, where it lay down submitting quietly to its fate, whereas the slightest exertion would have extricated it, as it was only caught by the tip of one toe ; I have seen similar instances recorded.

Although fish forms the usual food of the otter, when hard pressed it is by no means particular as to its diet ; during a hard winter many years ago, a large male otter was killed in a sheep-fold at Briston, a considerable distance from any stream, it was found regaling itself on a sheep which it had killed ; it has been known to kill and partly devour a young pig, an occasional rabbit does not come amiss when hard pressed ; the remains of water-fowl have been found in their stomachs, and frogs and slugs are taken probably as delicacies. It is also suspected of making an occasional meal off fresh-water mussels. I fear it must be confessed that the otter is a wasteful feeder, and that where valuable fish are cultivated it commits sad havoc ; in trout and salmon streams, however, it is open to the old English mode of attack, now almost forgotten, and those who have joined in otter hunting speak with perfect enthusiasm of the sport, from the drag to the finish, no other sport affording an equal amount of healthful exercise and excitement. In the first volume of *Land and Water*, at pp. 398 and 442, will be found two articles on the mode in which the otter captures its finny prey, evidently written by a

close observer of nature, and one well acquainted with the habits of this animal; to these articles I must refer you for a graphic description of such a scene as I imagine it has fallen to the lot of few to witness.

Near Norwich the otter has been met with several times at Keswick and Eaton; Mr. Gurney mentions a female and young one taken from under the floor of the bathing house at Heigham, and one in the city itself, killed by the late Mr. Horton in his dyeing yard adjoining the Wensum. A gentleman told me early in September, 1870, that as he was coming into Norwich by the Eastern Union Railway, he saw from the carriage window two otters playing on the river bank, where the railway crosses it; at Lakenham; but of course it is rarely they approach so near the busy haunts of man. The reed-cutters and broad-men sometimes see them floating lazily on the surface of the water, or cautiously swimming, all but the nose submerged, yet progressing through the water so quietly that the small exposed surface may easily be mistaken for a water-rat. It sometimes also happens that the bow-net is found to be unusually heavy, and the man rejoicing in the prospect of a splendid haul of tench, finds the net not only occupied by the fish, but by the fisher also. A large otter weighing 27 lbs. was thus taken at Ormesby, and two others at Carlingford. When we consider the nocturnal habits of the otter—its stealthy, silent mode of progression, the obscure colour of its coat, and the peculiar nature of its haunts—it is no longer surprising that so little should be known of its economy even by those who have spent their lives where it most abounds, or have made it an object of sport. I venture, therefore, to call your attention to one or two obscure points in the history of the otter which I have been at some pains to try and elucidate so far as my opportunities will enable me.

It was a “fine, fresh May morning” when Piseator and his friends sallied forth to fish the river Ware. One of their first adventures was the meeting a party of otter hunters*; after having killed “a bitch otter, which had lately whelped,” a short search discovered her young ones “no less than *five*” in number. Now either honest Isaac must have drawn upon his imagination in the matter of the young otters, or the otter itself must of late years have changed its time for assuming the cares of maternity. There has always been a shade of mystery about the breeding of the

* Walton and Cotton's *Complete Angler*, Major's Edit., 1823, p. 50.

otter, which has not been removed when some searcher after the truth has addressed a query to one of the Natural History publications of the day; the answers, when the question was replied to at all, have been sufficiently contradictory, but not by any means satisfactory. I will first give a few extracts from different authorities, and then the result of my own observations.

In *Land and Water* for the year 1867, there was a discussion as to the time when the otter breeds. V. A. B. writes, that he has never been able to get a really satisfactory answer to this question, but his "own experience leads him to think they breed in the middle of winter, that is, in the months of November and December; but 'an otter hunter, of forty years' standing,' has come to the conclusion that they are irregular breeders, 'after the manner of dogs,' as he has found their very young cubs in almost every month in the year." "Germanicus" has observed the otter in Germany, and says there "their pairing time is in January and February, when they may be heard calling to one another by means of a loud species of whistling cry; they breed nine weeks after pairing, when they lay up from two to four cubs." C. H., quoting Buffon, says, that in France the otter couples in the winter, and brings forth in the beginning of spring; but that Goldsmith says, it is certainly different with us, for its young are never found till the latter end of summer. He also says, that Goldsmith quotes Mr. Lots, of the Academy of Stockholm, that it couples about the middle of summer, and brings forth at the end of nine weeks, generally three or four young at a time. Mr. Lloyd, in his *Game Birds and Wild Fowl of Sweden and Norway*, says, that "in the southern parts of Scandinavia, the otter pairs in February, but in the northern, in March; the period of gestation," he says, "is nine weeks, and the cubs which follow the mother during the summer are two to four in number." Pennant says, "the otter brings forth four or five at a time," but does not mention the month. In Daniels' *Rural Sports*, it is said to "bring forth four or five young at a time, about the month of June." Jenyns says, "breeds in March . . . and produces four or five at a birth;" and lastly, Bell gives March or April as the time, and three to five as the number of young ones. The result of my experience, which has been confined almost exclusively to Norfolk, is, that the otter produces her young ones from December to February, is not double

No.	WHEN TAKEN.	No. of young.	PRESUMED		REMARKS.
			AGE.	DATE OF BIRTH.	
1	Jan. 9, '51	3	1 month	Dec. 9	<i>Three</i> young ones, 18 or 19 in. long, taken from the nest in Ranworth Fen, by Rev. P. Elwin.
2	Feb. 27, '64	3	2 months	Dec. 27	<i>Three</i> young ones, 26 in. long, taken at Hunstanton, the old female had been killed a few days previously.
3	March 28, '64	3	1 month	Feb. 28	<i>Three</i> young ones taken from under the floor of a bathing house at Keswick; very young, but age not stated. The old ♀ killed.
4	Feb., '38 or '39	1		Feb.	<i>One</i> very young one, same place as above.
5	Feb (middle) '65	4		Jan.	<i>Four</i> young ones found in a nest at Dilham, ♀ killed.
6	Feb., '65	2	6 days	Feb.	<i>Two</i> young ones, apparently about six days old, sent to Gunn.
7	Feb. (early) '66	2	2 weeks	Jan.	<i>Two</i> very young ones, from Gillingham, sent to Gunn.
8	Jan., '68	2		Dec. ?	<i>Two</i> young ones, from N. Wootton, and ♀ sent to Gunn.
9	Feb. 27, '69	1		Jan.	<i>One</i> young one, from Hickling, sent to Gunn.
10	March 9, 69	2	3 weeks	Feb.	<i>Two</i> young ones, taken from a nest in a straw stack at Trigby, brought alive to Gunn.
11	March, '69	2	2 weeks	Feb.	<i>Two</i> young ones, about two weeks old, with the ♀ from near Yarmouth, brought to Gunn.
12	Xmas.	3	2 or 3 wks.	Dec.	<i>Three</i> young ones taken from the nest by the Barton Broad keeper, considered by him two or three weeks old.
13	Feb., '72	3	3 weeks	Jan.	<i>Three</i> found by Cox, on Sutton High Fen. They were like little kittens, and died in three days.
14	Oct., '72	1	Few days	Oct.	This young one was brought from the nest by a dog, to the Rev. T. J. Blofeld, whilst snipe shooting at Hoveton.

brooded, and that the number is from one to three, rarely exceeding the latter. As this is a matter of some interest, it is as well to give the data upon which my opinion is based. See table p. 84.

It will be observed that out of the fourteen instances in which *very young* otters occurring in this county, have come to my knowledge, the earliest date was some time in the month of October, and the latest the 28th of March. My first date I am inclined to regard as quite exceptional; and with regard to the others, I have endeavoured to ascertain, as nearly as possible, the age of the young ones when taken, in order to be able to tabulate them under the date of birth. In some of the cases there has been very little uncertainty as to their age, others are rather doubtful, but as the two young ones, born in the Zoological Gardens, left the nest when five weeks old, and took to the water with the parents at seven weeks, we may fairly presume that all those found in the nest were not more than five weeks old; such being the case, with the single exception of Mr. Blofeld's young one, all those, to the age of which we have any clue, may be referred to the months of December, January, and February—the proportions being as follows:—1 in October; 4 in December; 4 in January; and 5 in February—14.

A female otter, (*Land and Water*, 9th April, 1870,) was killed on the river Avon, in Hampshire, in March, 1870; five days after the old one's death, her *three* young ones came up to the legs of a gardener who was digging near the river; they are said to have been the "size of small tom-cats," and supposed to have been five or six weeks old. They appear to have been caught on the 19th of March, and supposing them then to have been seven or eight weeks old, they would have been born on the 22nd or 29th of January. A cutting from the *Liverpool Courier*, quoted in *Land and Water*, for 4th March, 1871, states, that on Sunday, the 29th of January, William Jones, a plate-layer, was taking a walk on Bidstone Marsh, near the head of Wallasey Pool, when his dog lighted upon a female otter, and followed her into her hole; the otter was killed, and Jones, finding her in milk, searched for her young ones, the result was, "a lively pup, about three feet long," which was captured without injury. I think, however, there must be some mistake about the "lively pup's" length.*

* Since the above was written, a young otter, one of two sent up from Cornwall for the Brighton Aquarium, has died in the Zoological Gardens,

That the otter is double brooded, I have not a particle of evidence to show ; in no instance has it come to my knowledge, that very young ones have been found in summer, and the fact that the young ones do not quit the parents till nearly full grown, is, I think, sufficient to render it extremely improbable that it produces twice in one year. The fen-men will all tell you that the winter is the time to look for young otters, and all agree that mid-winter is the time when they are produced. In the instance of the pair which bred in the Zoological Gardens in 1846, the circumstances were altogether abnormal, the male not having been introduced till the month of March, and then in so sorry a plight as to be only half his original weight ; it is worthy of remark, however, as nine weeks is universally allowed to be the period of gestation, that it was rather over sixteen weeks from the time when he is supposed to have chanted his love-song, to the birth of the two young ones. Whether the otter utters this cry only during the pairing season, I cannot say ; (in the above case it was continued only four or five nights,) but one of the broad keepers, who compared it to the cry of a sea-gull, thinks that such is the case.*

The number of young produced at a birth is from one to four, but in only one instance (No. 5) the latter. In the cases of Nos. 6, 7, and 9, it is possible all the young ones may not have been secured ; in the remaining eleven instances, the proportions were as follows—in two instances there was one young one ; in three, two ; in five, three ; and in one, four. I believe the female otter has only four mammae, but this I have not had an opportunity of verifying. Should such prove to be the case, I think it would be strong evidence in favour of the number of young ones being rather under than over four, as it is not often the number of young

Regent's Park, where it was temporarily lodged. This little one died on the 23rd of February, and Mr. Bartlett thinks it was from two to three months old ; it would, therefore, have been born in the end of November, or early part of December. In a recent number of *Land and Water*, a correspondent says, that on the 15th of December last, "a young otter, which could not see, (*sic*) was picked up dead on the bank of the Went," a tributary to the river Don. A female, heavy with young, was killed on Barton Broad, on the 23rd of February last. See also note at page 87.

* I have somewhere seen the otter spoken of as the "whistling otter," a term which very well describes the ordinary sound emitted by it.

exceeds that of the separate sources provided for their nourishment.*

The place usually chosen by the otter for depositing her young, is a hole in the bank of a river, the lower part of a hollow tree, an old drain, or some such locality; Nos. 3 and 4 were found under the floor of a bathing-house; the nest of No. 4, Mr. Gurney describes as composed wholly of ivy leaves, and only just large enough to contain the single young one, which was about the size of a large rat. The nest found at Ranworth from which the three young ones (No. 1) were taken, Mr. Elwin says was near the water, under the remains of a decayed stump; it was full of reeds, the inside appearing to be lined with the feather part of them, it was very warm, and had an inlet near the top but a little on one side. No. 10 young ones were taken from a nest under a straw stack at Trigby, three-quarters-of-a-mile from the water. I am indebted to Mr. F. Norgate, of Sparham, for first calling my attention to a form of "nest" which I have since found is not unusual in the reed-beds of Norfolk, and which I can only imagine (if peculiar to this reedy district, as I have reason to believe it is,) is owing to the flat, treeless nature of the surrounding country. In the reed-beds where these nests are found the shelter is perfect, but any depression in the ground would instantly be filled with water, if,

* On the 15th of March, 1873, through the kindness of Mr. Cole, I had the opportunity of examining the fresh skin of a female otter, killed, with its single young one, two days previously at Ranworth. The skin had been roughly removed, and the mammary glands were left attached; those nearest the tail were distended, and full of milk. The posterior pair of nipples, which were evidently those used by the young one, were about three inches from the root of the tail, the second pair, three inches from these; the latter contained a small quantity of watery fluid, but presented no appearance of having been sucked. We could find no trace of a third pair of nipples, although we removed the fur from one side for that purpose. The young one (also a female) killed at the same time, measured 20 inches, and weighed $1\frac{3}{4}$ lbs.; it was believed by the marshman, by whom the old female was known to have frequented the neighbourhood where she was killed, for some time past, to be about two months old, and I am inclined to think, from the forward state of its teeth, which must already have rendered its visits to its parent somewhat painful, that, notwithstanding its small size, his estimate is about correct. The young ones born at the Zoological Gardens took fish at about seven weeks old, and I think the present little one would not be far from that age.

indeed, the reeds do not grow in the shallow water, or the hillock upon which it is placed be not actually afloat. The nest referred to (No. 5) was found in a reed-bed near Dilham, in February, 1865; the man who found it describes it as a "hillock of rushes and all manner of weeds" as much as would fill a cart, "it had three or four side entrances and one at top; Mr. Norgate adds, "the man saw the old one in the nest through the top hole, through which he made a dash with his hands; the otter attempted to make her escape through one of the side holes, the man caught hold of the otter's tail, the otter instantly turned round and bit the man's marsh-boot quite through." The nest was found in cutting the reeds, and was situated in the centre of the reed-bed, about thirty yards from the water. The four young ones which this nest contained were taken alive to Mr. Taylor, of Dilham, who a few days after shot a female, which he believes to have been their mother. The Hoveton nest from which No. 14 young one was brought by the dog, is thus described by the broad-keeper, Hewitt, to the Rev. T. J. Blofeld, to whom I am indebted for the information; it "was placed in an impenetrable morass on the top of what we call a 'gnat-hill' or 'tussock,' and was composed of little more than the rough herbage of the gnat-hill itself." The Ranworth keepers speak of the otter's nest as a heap of rough stuff collected together in a reed-bed; Wright has twice found such a nest, the last time four years ago. Platford, the Barton Broad keeper, speaks of the nest as a lump of grass, &c., on a hillock or "hover" near the side of the broad—from such a nest he took the three young ones, No. 12. He has found at least ten such nests in all, two this winter, one on the 23rd of November, which was destroyed by the water rising over it, and another about the same time in a different part of the broad. The second nest he found when reed-cutting, it was on what he calls a "hover," a sort of island in the morass which rises with the water, and is so favourite a resort of the otter that he frequently stops in passing such a spot to examine it for one. Thinking there might be an otter inside he thrust his fork into it, but the quantity of material was so great as to prevent the fork reaching the beast, if it really was inside at the time. The nest, which was still quite warm inside, was carefully constructed of reeds, and lined with reed tops and "champed" stems. Whether any of these ten nests may have

been simply the resort of an otter during the day I cannot say, Platford is confident such is not the case, and it is evident from his having found one actually containing young, that he is acquainted with the appearance of the genuine nest. I have never heard of this form of nest before, and should it be peculiar to the wet, reedy margins of our broads, it certainly is a most remarkable instance of the power of these intelligent animals to adapt themselves to circumstances, and reminds us of the skill and intelligence displayed by the beaver in the construction of its "lodge." In an account of the otter, printed in 1693, it is said:—"It makes its den very admirably, like as the beaver does, with wood and beams laid across," and old writers give very "artificial" accounts of its habitation; were such a structure known to them as that described by Mr. Norgate there would be some slight foundation for these stories.

The weight of a full-grown otter is from 14 lbs. to 30, or even 37 lbs.; a male killed at Ranworth, in January, 1871, after three weeks' intense frost, although in a very emaciated condition and quite empty, weighed 30 lbs., its length being $50\frac{1}{2}$ inches; a male killed in March, 1866, weighed 30 lbs.; an old male killed on the 3rd of the present month, by young Mr. Rinder, at Bowthorpe, weighed 37 lbs., being 48 inches in length; these, however, are quite ordinary beasts compared with one, also a male, taken by the Carmarthen otter hounds at the Cowen, and which "an old sportsman" says (*Land and Water*, vol. ii, p. 51) he saw killed and weighed; the weight was 50 lbs. and the length from tip to tail 66 inches! The adult female weighs considerably less than the male; the weights and measures of an adult male and female, both taken at the same season of the year, were as follows:—male, weight 23 lbs., length 50 inches; female, 16 lbs. and 46 inches. A young male and female, probably nine months old, weighed and measured as follows:—male, 9 lbs. 4 ozs., $37\frac{1}{2}$ inches; female, 9 lbs. 1 oz., and $35\frac{1}{4}$ inches. The fur of the otter consists of an outer coat of long hair, stiff and shining, admirably adapted for passing through the water without resistance, and an under-coat of fine, soft fur (like that of the fur seal, which supplies the "seal-skin" now so much in use) equally well contrived for its purpose, that of maintaining animal heat, the whole forming a beautiful water-proof and non-conducting covering.

In conclusion, my thanks are due to those gentleman whose names I have mentioned in the course of this paper, for their kindness in supplying me with much valuable information, and their forbearance towards a troublesome correspondent ; also to the bird-stuffers of Norwich, particularly Mr. Gunn and Mr. Cole, who have given me every assistance and information in their power, and kindly afforded me many opportunities of examining in the flesh not only otters, but other Norfolk animals.

V.

ON THE EDIBLE FUNGI FOUND IN NORFOLK.

BY MICHAEL BEVERLEY, M.D.

Read 28th January, 1873.

I HAVE this evening to present to the Society a contribution towards a list of Edible Fungi found in Norfolk, and in doing so, I propose not only to call attention to these fungi in particular, but also to offer some remarks on edible fungi in general.

In many European countries fungi form a staple article of food and commerce, and they are eaten either in the fresh, dried, or preserved state.

In this country, although so many of the edible species exist, yet comparatively few are eaten ; this is explained partly by ignorance, and where ignorance ends prejudice begins, and fortunately so, for whilst such a want of knowledge exists, prejudice and fear are, to a certain extent, the best safeguards against the dangers which unquestionably surround those who, in many instances, eat 'mushrooms and toadstools' without any definite knowledge of either.

In order to make my list of Norfolk Edible Fungi as complete as possible, I wrote to several members of our Society for any particulars they could give me. The replies I obtained were mostly to the effect that the writers had never taken up the study of fungi, and were, consequently, ignorant about them. One gentleman to

whom we all look as our botanical authority, wrote, in answer to my letter, as follows :—

“I am sorry I can give you no help about the fungi. I have not studied them, and as I have found genuine mushrooms very plentiful, and very cheap in Norwich, I have carefully avoided hazardous experiments. If I had time, I should much like to go in for them as a study.”

I mention these circumstances, and quote this letter, simply to illustrate, from amongst ourselves, the truth of the statement, that a want of knowledge, coupled with prejudice, and thence a wholesome fear, are the reasons why, with us, in contradistinction to our Continental neighbours, esculent fungi do not form an important article of food and commerce.

I remember being particularly struck with the large quantities of fresh fungi in the markets of Rome, Naples, and Venice, in the autumn of 1869. In these cities are inspectors, whose duty it is to see that the fungi offered for sale are not only of the species considered by them to be esculent, but also that they are all perfectly fresh, and fit for human food. I am not so well versed, as perhaps I ought to be, in the details of our recent Sanitary Acts, and therefore I am not aware if any special provision has been made in them to secure to us the same advantage and immunity enjoyed by the Italians. Is it expected or required of our future medical officers of health, that they should possess a practical knowledge of fungology? It is to be hoped that our far-seeing legislators have not omitted this, as such a requirement would not only have the effect of leading medical men, in their student life, to become acquainted with a branch of botany at present almost entirely neglected, but would also, to a certain extent, be the means of giving confidence to the public, by securing that the fungi exposed for sale, if not strictly common mushrooms, were, at all events, fit for human food, and thus a step would be gained towards doing away with the ignorance and prejudice now surrounding the subject.

In Badham's work on esculent fungi are some curious statements as to the consumption of fungi in Italy. He says that in Rome itself the commercial value of fresh and dried fungi averaged annually £4000. Rome, at that time, (*i.e.*, 25 years since,) had only 150,000 inhabitants, and “what” he says, “must be the net

receipts of all the other market places of the Italian States, if this result obtains in Rome only."

How are *edible* to be distinguished from *poisonous* fungi? So far as I have been able to learn, the only real way of distinguishing an edible from a poisonous fungus, is by finding out the species to which it belongs. In botanical works we find laid down for our guidance certain rules, but they have all exceptions, more or less, and are not absolute. I will name some of them.

EDIBLE

v.

POISONOUS.

Edible mushrooms are said for the most part

1. To grow in solitary and airy places.

2. *Colour*, generally white or brownish.

3. *Flesh*, compact and brittle.

4. Do not change colour when cut, or from exposure to air.

5. *Juice*, generally watery.

6. *Odour*, agreeable.

7. *Taste*, neither bitter, acrid, nor astringent.

8. Insects will eat them.

9. Generally free from spots or scales.

Poisonous mushrooms, on the contrary, generally grow

1. In clusters, in woods, and damp places.

2. *Colour*, usually bright.

3. *Flesh*, tough and watery.

4. *Do* change colour when cut, brown, green, or blue.

5. *Juice*, generally milky.

6. *Odour*, generally disagreeable and powerful.

7. *Taste*, acrid, bitter, and astringent.

8. Insects will *not* eat them.

9. Often scaly or spotted.

These rules, useful to a certain extent for diagnosis, are most of them open to exceptions, as will be seen by some of the species to which I shall allude this evening. The only general rule is, that if a fungus tastes hot, and has a disagreeable aroma, it is unsafe to eat it, as it is most likely poisonous; if, however, it has a delicious flavour, and an agreeable aroma, it is safe and edible. The exceptions to *this* rule are very rare.

Mr. Worthington Smith, in his popular and excellent little book on 'mushrooms and toadstools,' of which I have made great use in arranging these notes, says, that no one can be a sure guide to others who is not himself a regular fungus eater, and that no descriptions can be of value, nor drawings of use, unless they are made, with the greatest care, from the objects themselves. To this end he has published two charts, known to most of you, and one

of which, containing twenty-nine edible fungi, I have brought this evening, to illustrate some of the species found in this county.

Writing on the subject of mushroom poisoning, my friend, Mr. Amyot, states, in a letter to the local papers of December 4th, 1871—

“I would notice the process by which, on the authority of M. Gerard, almost any kind of mushroom may be deprived of its dangerous qualities. He directs that the caps should be cut into four or eight pieces, according to size, and soaked in weak vinegar and water, one tablespoonful to the pint, for two hours; they should then be taken out and washed with plenty of cold water; they are next to be put into cold water, and boiled for twenty minutes, again washed with cold water, wiped and dried, and then cooked according to taste. Thus prepared, M. Gerard and his family have eaten the most poisonous kinds with impunity; and whilst strongly advising that no rash experiments should be tried, I may express my opinion that accidents would be avoided, if all mushrooms commonly eaten were treated in this way, for the deleterious principle, *amanitine*, is extremely soluble in water, and could hardly fail to be removed by such a process, so that a mistake in the selection of species, or the use of one reputed wholesome, but grown or gathered in an unhealthy condition, would be attended by no ill result.”—T. E. A.

The differences observed in the effects of the same species on different individuals, together with the fact that in France, Russia, and other countries, fungi are eaten which by us are regarded as poisonous, as also that the common mushroom (*Agaricus campestris*) so exclusively popular with us, is rejected in Italy, are conflicting points, which can only be reconciled by differences of soil, site, climate, and manner of cooking, and also, perhaps, by some peculiar idiosyncrasies of those who eat them. But although the common mushroom may vary in its wholesomeness in different countries and soils, there are other fungi which do not offer these differences, but are, authorities (Berkeley and Badham) inform us, in every respect just as wholesome when growing in this country where they are not eaten, as in those in which they form a staple article of diet; and it is more especially to some of these that I wish to draw your attention. *Agaricus procerus*, *prunulus*, *fusipes*, you will see, for example, duly recorded in my Norfolk list; by us they are eschewed—by the French and Italians they are largely eaten. The same remarks apply to *Fistulina hepatica*, *Boletus edulis*, and *Cantharellus cibarius*, whose edible virtues, you will

see, are certified by Messrs. Plowright, Trimmer, Miles, and myself.

I will conclude what I have to say on this part of my subject by a quotation from Badham. Speaking of the dangerous individuals which exist in the family of the fungi, he says, "We should apply the same rules of discrimination here as elsewhere; have we not picked potatoes for our table out of the deadly family of *Solana*? selected with care the garden from the fool's parsley? and do we not pickle gherkins, notwithstanding their affinity to the *Elaterium momordicum*, which would poison us were we to eat it? Ought we not, rather, in a matter of such importance, to apply ourselves to the task of discriminating them accurately, than permit idle rumours of its impracticability, or even of real difficulty, to deter us from the undertaking? Assuredly nature, who has given to brutes an instinct by which to select their aliment, has not left man without a discriminative power to do the same with equal certainty: nor does he use his privileges to their full, nor employ his senses as he might, when he suffers himself to be surpassed by the brute animals in their diagnosis of food."

As to properties, fungi may be divided into edible, medicinal, and poisonous, and it is to the first alone I confine my remarks.

Being so highly nitrogenous, and containing so large a proportion of phosphates, fungi, if edible, are highly nutritious. I have already stated that in Southern Europe they are very largely consumed, and Berkeley states that many savage tribes, the Fuegians for instance, adopt certain species as their staple food during many months.

In this country what is called the common mushroom (*Agaricus campestris*), and the horse mushroom (*Agaricus arvensis*), the champignon (*Marasmius oreades*), the morel (*Morchella esculenta*), and the truffle (*Tuber cibarium*), are the fungi which are almost exclusively eaten by either the public or the epicure; but besides these there are others growing in this county which are not only edible, but which if better known would soon be highly esteemed, not only as luxuries, but as valuable food.

Mr. W. Smith figures in his chart twenty-nine varieties, of which he says, "all and every one are delicious objects of food, full of aroma and flavour, most of them abundant, and easily recognisable when seen." Dr. Badham enumerates thirty species

whose edible virtues had been proved by himself and his friends. You will find in my list no less than thirty-five species or varieties growing in Norfolk, of which Mr. W. C. Cooke contributes twenty-four, Mr. Plowright, of Lynn, seventeen, these, together with information obtained from the Rev. Kirby Trimmer, Mr. Mills, of Fakenham, Dr. Crowfoot, of Beeches, together with some notes of my own, constitute the list which I present as a nucleus of what will doubtless soon be more extended, and hence more useful.

Lady Stracey, whose knowledge of British fungi is considerable, has very kindly lent me her collection of drawings of fungi taken from nature; this I have brought this evening to show you, there are many edible varieties amongst them. I regret that want of time has prevented my accepting her Ladyship's offer of enabling me to see the manuscript descriptions and drawings of fungi made by the late Mr. Ward, of Salhouse, which I believe is the very best of its kind. I will now proceed briefly to consider the individual fungi specified in my list, commencing with the genus *Agaricus*, of which no less than fifteen edible species and two varieties grow in this county, ten of which you will find figured in Smith's chart.

The meadow mushroom (*Agaricus campestris*) is the fungus almost exclusively eaten by the general public in this country. A writer in the *American World of Science* gives the following concise account of the difference between the edible mushroom and the poisonous fungi resembling it. First and foremost, the true mushroom (*A.c.*) is invariably found among grass, in rich open pastures, and never in or about stumps or in woods.

Many cases of poisoning have occurred owing to the supposed mushroom being gathered from stumps or in woods. It is true there is a certain variety of *A.c.* found in woods and woody places (*A. salvicola*), but as far as amateurs are concerned it is best left alone.

A second very good point is the peculiar intense purple colour of the spores—the ripe, fully-matured mushroom derives the intense purple brown colour of its gills from the innumerable number of these spores. To see these and to become acquainted with their peculiar colour, remove the stem from the mushroom, lay the upper portion with the gills lowermost on a sheet of writing paper, in a few hours the spores will be deposited in a thick, dark, impalpable powder. Sometimes the top is white and soft like kid

leather, at other times it is dark brown and scaly, its gills do not touch the stem and the top has an overlapping edge.

Although consumed so largely by us in this country this fungus is, as I think I have before said, not appreciated in Italy. I have noticed its absence from the market-places of Rome, Naples, and Venice, whilst other fungi were in abundance.

The ketchup made from this mushroom is generally considered to be the best, although Smith says that in Covent Garden the horse mushroom (*A. arvensis*) is almost exclusively sold for this purpose. Mr. Smith also states that cows will eat the meadow mushroom, if so its mysterious disappearance may often be due to bovine rather than to human marauders. Two varieties of *A.c.* are down in my list (1) *A. pratensis*, on the authority of Mr. Trimmer, and (2) *A. rufescens*, on that of Mr. Plowright.

A. pratensis differs from *campestris* in having hairs on the top of it, and its flesh being of a reddish colour, it is said to equal if not exceed *A.c.* in piquancy and excellence.

A. rufescens, Cook describes as a "distinct variety, whose flesh turns of a bright red when bruised, the gills being at first white." Mr. Plowright certifies to its edible virtues.

The horse mushroom (*A. arvensis*) differs from *campestris* (1) in the large size to which it often attains, (2) when bruised it turns yellow, (3) the gills are not pink but of a brownish-white. Although inferior in esculency to *A. campestris* it yields a large quantity of ketchup, and meets with a ready sale in the London markets. Smith says he once saw a sheep eating this mushroom.

Agaricus rubescens. Messrs. Crowfoot, Plowright, and Miles report on the red-fleshed mushroom. Smith says of it, "I well know it to be delicious and perfectly wholesome, as I have not only eaten it myself but I have known it to be largely eaten by many amateurs." Mr. Plowright also reports well of its esculent virtues. You will see it No. 1 on the chart, with its warty pileus, white gills and well marked ring.

Agaricus strobiliformis, the fir-coloured mushroom, is of rare occurrence. Mr. Plowright includes it in the Norfolk list. In Smith's chart it is No. 10, distinguished by its scales on the top like a fir cone.

Agaricus procerus, the parasol mushroom; a beautiful and delicate looking fungus, growing mostly in hedge banks and

pastures in autumn; in high esteem in Italy and in France. Paulet says of it, "Elle est d'un saveur très agréable, et d'une chair tendre très délicate et très bonne à manger. Les amateurs la préfèrent même au champignon de couche comme ayant une chaire fine et étant beaucoup plus légère sur l'estomac." My correspondent, Mr. Mills, of Fakenham, does not quite subscribe to this account, and says, "I do not like it at all when cooked;" he has found fine specimens of it at Fakenham. Messrs. Plowright and Amyot, however, speak well of it. I have never eaten it. It is marked 14 on Smith's chart; "it has a scaly top, a spotted, bulbous stem, and a ring which will move up and down."

Agaricus gambosus, the St. George's mushroom, 19 on the chart, comes up near St. George's day in the spring; said to be "a rare delicacy." Mr. Plowright is the only one of my Norfolk correspondents who has ever eaten it.

Agaricus ostreatus, the oyster mushroom, grows chiefly on trees, such as the elm, poplar, ash, willow. Although edible, Smith says, "a taste for this fungus has to be acquired, and is not of much value for culinary purposes."

Agaricus nebularis, so named from its cloudy, grey top, grows in woods in moist places. Mr. Amyot says it is not worth eating, Smith says it is—who shall decide when mycologists disagree?

Agaricus prunulus, plum mushroom, known by its ringless stem and pink gills running down it, and by its mealy smell; said to be "whether boiled, stewed, or however prepared, a most delicious morsel."

Agaricus personatus, lilac-stemmed mushroom, is a rare species, named, however, as growing in Norfolk by Messrs. Plowright and Cooke.

There are five other esculent agarics down in my list, but as they are of less frequent occurrence than those already named, I will not detain you by any description of them, but will finish what I have to say about the genus *agaricus* by referring to one species which is said by Badham and Worthington Smith to be esculent, but which, on the contrary, is highly dangerous, and has of late proved fatal in the Eastern Counties, I allude to *Agaricus vaginatus*. I cannot do better than quote what my friend Mr. Amyot has written concerning it, apropos of a case of poisoning from its use:—"Through the kindness of two friends residing

at Stamford, I have received specimens of the fungi which proved fatal to the late Mr. Welch, and from the ill effects of which a lady who also ate them, very nearly lost her life.

“It is not the *Amanita muscaria*, or Fly agaric, as it was said to be, but the *Amanita vaginata*, a species of far less suspicious appearance, and one possessing no disagreeable smell, nor other characteristics of its dangerous qualities. It is extremely common in most places, and shares the popular name of umbrella, with fifty other kinds; moreover, it is said to be wholesome, in many popular books on mushrooms, and one great object of my writing is to request the possessors of such works at once to correct the blunder in their copies, and thus to prevent mischief to those into whose hands they may fall. Mr. W. Smith, in the little book which accompanies his admirable charts, says thus, ‘A very common species of *Amanita*, “*agaricus vaginatus*,” said to be esculent, and eaten by Mr. Penrose, I have not tried.’ Let me hope he will *not* try it.

“Dr. Badham, in his *Esculent Funguses of England*, singles out this species as *the* esculent species of *Amanita*, and at page 129 enlarges on its excellence. He also quotes the following strong recommendation of it from *De Candolle*—‘*La concoumele grise (Agaricus vaginatus)* est une des espèces les plus délicates et les plus surs à manger.’ In the *British Fungi*, by Mr. Cooke, however, due caution is given as to the danger of eating this species, which, he remarks, “has not only enjoyed the reputation of being esculent, but also of being poisonous.”

Prepared after Gerard’s plan, already described, my friend Mr. Amyot writes, “I did prepare it, cook it, and taste it, after the fatal accident at Stamford; it appeared to me to have no attractions for table besides being dangerous.”

Boletus Edulis. Edible table mushroom. A large, thick, smooth fungus, of a brownish or blackish colour, with white or greenish tubes, and a reticulated stem, growing in woods. I noticed this fungus was extremely common in the Italian markets, apparently taking the place of the *A. campestris* with us. I have myself tasted young *Boletuses*, and can testify to their excellence, as also do Messrs. Plowright and Crowfoot.

Dr. Cuffe writes, in a recent number of the *British Medical Journal*, “I have gathered bushels at a time of the *Boletus edulis*,

in a fir plantation where, apparently, no other vegetable life would grow but the tree itself. The variety is most delicious, equal, (to my mind) if not superior to *Agaricus campestris*.

Marasmius oreades. Fairy ring champignon. The last named fungus, the Boletus, was of wood or forest growth—*this never is*. It is, in my experience, the most common roadside mushroom, but it grows in pastures and parks, even in Hyde Park, in Badham's time. Everybody knows the fairy rings, but few know that most of them are formed by fungi, which are, whether in the fresh or dried state, (to use Smith's words,) "so exquisitely rich and delicious in flavour, that no recommendation can be too strong for them." Mr. Berkeley says of it, "it is the very best of all our fungi." I have eaten these champignons fresh, dried, and in powder, and can fully endorse all the above-named authorities say of them.

Mr. John Henry Gurney, in a letter to me, speaks of an excellent pickle composed of the "Fairy Ring Fungus;" and Mr. Miles says, "I think highly of them, fried or stewed—I have also dried and preserved them."

The champignons may be dried, which is very easily done by the exposure of a few days to the air, and they will keep for years, still retaining their aroma. Mr. Amyot first introduced them to me in a powdered condition, in which state they make an excellent condiment, and appear to impart as much flavour to a dish as in their fresh state.

You will see depicted at fig. 28 the *Marasmius oreades*; it must be distinguished from the false champignon, *Marasmius urens*, which is poisonous, and as you will see in Mr. Smith's book, who relates that he once poisoned himself with it in Bedfordshire, having gathered *in the dark* some of both species.

The true champignon has a smooth, convex, sub-umbonate, sinuate pileus, tough and wrinkled, cream coloured, with gills far apart, and of the same colour as the pileus—never grows in woods—stem solid, twisted, and very tough, whitish—no hairs at base.

The false champignon, on the other hand, is more slender, pileus depressed and fragile, especially when moist—gills dark, and closer set—stem has downy hairs, and is hollow—often grows in woods.

Morchella esculanta. The morel. Mr. Crowfoot reports morels as rare about Beccles, but that he has seen them at Gilling-

ham and Shipmeadow. I have found them in my father's orchard at Seething. Mr. Amyot finds them around Diss. Mr. Trimmer says, "several greengrocers of Norwich have informed me that they are seldom able to meet with a demand for morels, and that it ends in their having to make them into ketchup for their own use, but that when they have an opportunity of sending them to London, they get a good price for them." He further says, that he has seen exposed for sale, in Norwich market, *Polyphorus frondosus*, on three occasions, at long intervals, under the name of morels—the price asked was from 6d. to 1s. 6d., according to size. I need not remark on their well-known esculency.

Lycoperdon giganteum. Giant Puff Ball. Edible properties testified to by Messrs. Plowright, Amyot, Crowfoot, Miles, and, I may add, myself. Mr. Miles writes, "Puff Balls, both giant and small, I have fried and eaten; they are good—the giant, when sliced about half-an-inch thick, and fried, resembles an omelette—the small sort are more like the common mushroom."

Helvella crispa. Curved helvella. This, with *H. lacunosa*, resembles morel in flavour, neither can be mistaken for any other fungus—they grow in woods, or on stumps of trees.

Cantharellus cibarius. Chantarelle—distinguished by its very yellow colour, and irregularly lobed pileus, and sweet "apricot" scent—mentioned by Messrs. Plowright, Trimmer, Miles, and Crowfoot. According to Badham, the fungus especially esteemed by the freemasons, who, he adds, "keep the secret of its excellence."

Fistulina hepatica. Liver fungus. Grows generally from the oak, but sometimes from the chestnut, from the branches of which it projects, a curious dark red mass, somewhat resembling liver—hence the specific name. It varies in size from one ounce to many pounds. Mr. Berkeley names one weighing thirty pounds. I have seen them of enormous size growing from the oaks in Seething Park. I have never tested its edible properties, nor have any of my correspondents, except Mr. Plowright, who says, "*Fist. Hep.* I have never been able to relish." Smith, however, says, "it is truly a vegetable beefsteak, for the taste resembles meat in a remarkable manner." Badham says, "Shoëffer calls it "the poor man's fungus," "*Fungus pauperibus esculentus*," and it deserves the epithet, if we look to its abundance, which makes it an acquisition to the labouring classes wherever it is known; but that it is

in any other sense fitted for the poor, or to be eaten by those only who can purchase no other food, is what I cannot subscribe to. No fungus yields a richer gravy, and though rather tough, when grilled, it is scarcely to be distinguished from broiled meat.

Hydnum repandum. Spine-bearing mushroom. Has been found in Norfolk, by Mr. Trimmer, but is not named by Messrs. Plowright or Cooke in the lists they have kindly sent me. Roques says of it, "the general use made of this fungus throughout France, Italy and Germany, leaves no doubt as to its good qualities. It may be known by its irregular tawny pileus, with *spines* on its under surface, these latter being characteristic.

Polyporus giganteus et frondosus. Named by Messrs. Trimmer and Cooke, the latter by Mr. Trimmer as being sold in the Norwich Market Place as morels—this I have previously alluded to. The species are not included in Smith's chart or book, they are better known on the Continent than in England, where they are rare. (Badham.)

Hygrophorus virgineus. White viscid mushroom. Is common enough, as is also *H. pratensis*; they grow in the autumn on pastures and lawns—small, white, and waxy—esculent when fresh.

Lactarius deliciosus. Orange milk mushroom. This mushroom, with such a charmingly suggestive name, grows in fir plantations; when bruised, it exudes orange coloured pieces, which become green on exposure to air, and by this is distinguished from other and poisonous varieties, whose juice is white, and is not changed by exposure. Sir James Smith says, "it fully deserves its name, being the most delicious mushroom known." Messrs. Cooke, Plowright, and Trimmer, include it in their lists, and Mr. Plowright praises its edible qualities.

Coprinus comatus. The maned mushroom was, I believe, exhibited at a recent meeting by Mr. Southwell. Owing to its cylindrical campanulate pileus, of a beautiful white colour when fresh, (and in this state alone is it edible,) it cannot be well mistaken. As to esculency, Mr. Smith is loud in its praises.

Clavaria vermiculata. Candle clavaria, is mentioned only by Mr. Cooke. It grows in white bundles, and, says Smith, "when cleaned and stewed, or broiled, will form a novel and tasty adjunct to any dish, and when once tried, will be eagerly sought for in future."

The two last on my list are—

Peziza venosa et acetabulum, reported by Messrs. Cooke and Plowright, Norfolk specimens. I do not know them, nor are they contained in Smith's list. Mr. Plowright writes, "Dr. Bell, of Hereford, states that he has eaten them several times this spring—the powerful odour of nitric acid was, however, sufficient to deter me." Badham says of them, "they are not to be despised when one cannot get better, nor to be eaten when one can." Thus they may be put down low in the esculent list. I have placed them last in mine.

I cannot conclude my paper without quoting the following remarks from Badham. After describing an Italian mycological tour, he says, "But not only in Italy, in our own country also, the collector in mycology will have to traverse much beautiful and diversified scenery; amid woods, greenswards, and winding lanes, rich meadows, healthy commons, open downs, the nodding hop grove, and the mountain sheep path—and all shone upon by an autumnal sunset, as compared with Southern climes, 'obscurely bright,' and unpreceeded by that beautiful rosy tint which bathes the whole landscape in Italy, but with a far finer background of clouds to reflect its departed glories, and throughout all this range of scenery, he will never hunt in vain. In such rambles he will see, what I have this autumn myself witnessed, whole hundred-weights of rich, wholesome diet, rotting under trees, woods teeming with food, and not one hand to gather it, and this, perhaps, in the midst of potato blight, poverty, and all manner of privations, and public prayers against imminent famine.

"I have indeed grieved when I reflected on the straitened condition of the lower orders, to see pounds innumerable of extempore beefsteaks growing on our oaks, in the shape of *Fistulina hepatica*, and *Agaricus fusipes* to pickle, in clusters under them. Puff balls, which some of our friends have not inaptly compared to sweet-bread for the rich delicacy of their unassisted flavour. *Hydna*, as good as oysters, which they somewhat resemble in taste. *Agaricus deliciosus*, reminding us of tender lamb kidneys; the beautiful yellow *Chantarelle*, that "kalon kagathon" of diet, growing by the bushel, and no basket but our own to pick up a few specimens in our way; the sweet, nutty-flavoured *Boletus*, in vain calling himself *edulis* where there was none to believe him—the dainty *Orcella*—the *Agaricus heterophyllus*, which tastes like the craw-

fish when grilled—the *Agaricus ruber* and *Virescens* to cook in any way, and equally good in all—these were the most conspicuous of the trouvailles.

“The finder may at first alarm his friend’s cooks, but their fears will, I promise him, soon be appeased after one or two trials of this new class of viands, and he will not long pass either for a conjurer or something worse in giving directions to stew toadstools. As soon as he is initiated in this class of dainties he will, I am persuaded, lose no time in making the discovery known to the poor in the neighbourhood, while in so doing he will render an important service to the country at large, by instructing the indigent and ignorant in the choice of an ample, wholesome, and excellent article, which they may convert into money or consume at their own tables (when properly prepared) during the winter.”

In conclusion, allow me to thank you for the kind and considerate attention you have given to a paper in which the author has introduced nothing new, nor offered anything original, but has sought rather to direct attention to the edible properties of a list of fungi growing in our county, more in the useful and domestic sense, than from a scientific or botanical point of view, in the hope that some of them may be more generally adopted as suitable for human consumption.

But although thus expressing this hope, far be it from my intention to convey the impression that without due knowledge and proper precautions, fungus food is to be adopted by the public generally. To this point, and to the dangers surrounding it, I have in the first part of my paper drawn attention; I do not wish to remove the prejudice and leave the ignorance—it is the latter I seek to remedy by a slight contribution to our Society’s records, and by asking the attention of our members to a much neglected subject, in which may be found ample means of acquiring useful knowledge and instructive amusement.

Knowledge thus gained, and let us hope disseminated, will be the means of still further instructing others, so that the numerous fungi which are edible may be known to the many and not, as at present, to the few, and thus tend to secure, under proper precaution, the sale in our markets of food which is the nearest approach to that highly prized and priced article *Butcher’s Meat*.

EDIBLE MUSHROOMS FOUND IN NORFOLK.

NAMES.	AUTHORITIES.
AGARICUS CAMPESTRIS, <i>meadow mushroom</i>	Trimmer
" " var. <i>pratensis</i>	Plowright
" " " <i>rufescens</i>	
" ARVENSIS, <i>horse mushroom</i>	Plowright, Crowfoot, Miles
" RUBESCENS, <i>red-fleshed mushroom</i> ..	Plowright
" STROBILIFORMIS, <i>fir-cone</i> " ...	{ Aymot, Cooke, Crowfoot, Beverley, Plowright, Miles, Lady Stracey, Barrett
" PROCERUS, <i>scaly or parasol</i> " ...	{ Trimmer, Plowright, Cooke, Barrett
" GAMBOSUS, <i>St. George's</i> " ...	{ Plowright, Cooke, Lady Stracey, Beverley
" OSTREATUS, <i>oyster</i> " ...	{ Amyot, Cooke, Plowright, Barrett
" NEBULARIS, <i>clouded</i> " ...	Plowright
" PRUNULUS, <i>plum</i> " ...	Plowright, Cooke
" PERSONATUS, <i>lilac-stemmed</i> " ...	Cooke and Ward of Salhouse
" ODORUS, <i>sweet</i> " ...	Cooke
" ULMARIUS, <i>elm</i> " ...	Cooke, Lady Stracey
" FUSIPES, <i>spindle-shaped</i> " ...	Cooke, Lady Stracey
" MELLEUS, <i>honey-coloured</i> " ...	Cooke
" MUTABILIS	{ Plowright, Trimmer, Crow- foot, Beverley, Lady Stracey, Barrett
BOLETUS EDULIS, <i>edible tube mushroom</i>	{ Cooke, Plowright, Amyot, Crowfoot, Lady Stracey, J. H. Gurney, Beverley, Miles, Barrett
MARASMIUS OREADES, <i>fairy ring champignon</i>	{ Cooke, Plowright, Amyot, Beverley, Trimmer, Lady Stracey, Barrett
MORCHELLA ESCULENTA, <i>edible morel</i>	{ Plowright, Aymot, Crowfoot, Miles, Beverley, Barrett
LYCOPERDOM GIGANTEUM, <i>giant puff ball</i>	{ Cooke, Trimmer, Plowright, Amyot, Beverley, Barrett
HELVELLA CRISPA, <i>curled helvella</i>	Plowright
" LAGUNOSA	{ Plowright, Miles, Trimmer, Crowfoot, Lady Stracey, Beverley, Barrett
CANTHARELLUS CIBARIUS, <i>chantarelle</i>	{ Cooke, Plowright, Beverley, Lady Stracey, Barrett
FISTULINA HEPATICA, <i>liver fungus</i>	Trimmer, Barrett
HYDNUM REPANDUM, <i>spine-bearing mushroom</i>	Cooke, Trimmer
POLYPORUS GIGANTEUS	Trimmer, Barrett
" FRONDOSUS	Cooke, Plowright, Barrett
HYGROPHORUS VIRGINEUS, <i>viscid white mushroom</i>	Cooke, Plowright, Barrett
" PRATENSIS	{ Cooke, Plowright, Trimmer, Lady Stracey
LACTARIUS DELICIOSUS, <i>orange milk mushroom</i>	Cooke, Lady Stracey
CLAVARIA VERMICULATA, <i>candle clavaria</i>	{ Plowright, Miles, Beverley, Lady Stracey
COPRINUS COMATUS, <i>maned mushroom</i>	Cooke, Plowright
PEZIZA VENOSA	Cooke, Plowright
" ACETABULUM	Cooke, Plowright

VI.

REMARKS ON
THE "WILD BIRDS' PROTECTION ACT" OF 1872.

BY HENRY STEVENSON, F.L.S.

Read 25th March, 1873.

HAVING last year occupied some portion of my Address to the members of this Society with the consideration of a proposed bill for the protection of wild fowl, strongly urging the necessity for some such Act being passed to preserve the indigenous species therein named, I would further ask your attention whilst I explain the circumstances which led to the altered title of that bill, and the introduction into the schedule attached, of a large number of birds whose protection was never contemplated by the original promoters. The bill, entitled "An Act for the Preservation of Wild Fowl," was introduced into the House of Commons by Mr. Andrew Johnstone, M.P. for South Essex, and read a first time on the 15th of February, 1872; but its second reading was unavoidably postponed till some time in June. In the meanwhile a letter to the *Times*, by the Baroness Burlett Coutts, on the wholesale capture of nightingales in the neighbourhood of London, seems to have incited certain small bird protectionists in this country to endeavour to convert Mr. Johnstone's bill to their own ends and purposes; and Mr. Auberon Herbert, as their mouth-piece, on the second reading carried a resolution to the effect that it be suggested to the Committee to extend the provisions of that bill to "small birds generally." The task thus imposed upon the committee was no light one, inasmuch as Mr. Herbert's "suggestion" at once roused that very spirit of opposition from class interests which Mr. Johnstone's bill had been specially framed to avoid, and to mitigate, therefore, the inevitable wrath of the farmers should they find an Act passed to protect sparrows, the following pro-

pitiatory clause was, in the first instance, adopted, which would virtually have rendered the intentions of the small birds' friends of little or no effect.

“The magistrates of any county at quarter sessions assembled may by resolution except any species of birds from the protection afforded by this Act, and such exception may apply either to the whole of such county or to any part or parts of it as the said magistrates may decide : Provided always that such exception shall be duly published from time to time in such manner as the said magistrates may think fit ; provided also, that such exception may be rescinded by the said magistrates at any court of quarter sessions held within such county ; provided also, that in all cases in which the magistrates shall have excepted any species of birds from the operation of this Act, and shall have subsequently repealed such exception, no penalty shall be inflicted under this Act unless due notice shall have been first given for not less than three clear months that such exception has been repealed.”

Possibly the absurdity of such a provision in a wild birds' *protection* bill led eventually to the appointment of a Select Committee, with instructions to make such amendments in the bill as would be necessary under its altered title, and to include in the schedule such other birds as they might think desirable. At this stage of proceedings Mr. Clare Sewell Read, M.P., who, as a representative of the agricultural interest, had most properly been placed on the Committee, requested me to furnish him with a list of such birds as might without prejudice be added to the schedule, including of course those insectivorous kinds which render essential service to man, or those which, from their rarity or the beauty of their plumage or song, need special protection. Of the twenty names I selected, all but three (the blue, marsh, and coal tits) will be found in the schedule of the new Act. Many of them were proposed and carried by Mr. Read himself, and naturalists are specially indebted to that gentleman for the introduction of the bittern (strangely enough, omitted from the Wild Fowl Bill) and the beautiful, and therefore persecuted, bearded tit of our Norfolk broads. Looking at the schedule, however, as it now stands, it would be as difficult to explain why certain birds are included, as to find a satisfactory reason for the exclusion of others. Why the robin and the hedge-sparrow should need protection in this country, where small birds are not eaten as they are on the continent, I am at a loss to imagine; the robin more especially, over whom the

ægis of local superstition casts a more effectual protection than any Act of Parliament could possibly afford. Again, I have been asked repeatedly why the handsome chaffinch, and our three or four useful species of titmice were omitted from the list. My only answer is, that so it seemed best to the Committee, whose decision upon the merits or demerits of certain species, was, doubtless, arrived at from a purely agricultural and horticultural point of view, and guided, I fear, in many instances rather by ancient prejudices than by personal acquaintance with their habits. In looking over a report of the proceedings of the Select Committee it is amusing to observe the divisions which took place for and against the introduction of certain birds into the schedule. The hedge-sparrow was elected by the casting vote of the chairman, the opposition possibly originating in the term sparrow, so erroneously applied to this inoffensive species. The owl (including, of course, all resident species) was happily installed by a majority of fourteen to four; which shows how strong is now the feeling in favour of these birds as vermin killers, notwithstanding the high game preserving tendency of the age. And the whinchat also owes its place to the chairman's casting vote, but why opposed or supported it would be equally difficult to explain; more particularly since the election of its twin-brother, the stonechat, was not even questioned. For my own part I should have voted against both, and several others besides, as perfectly capable of taking care of themselves.

Blackbirds and thrushes, which certainly need no protection in this country, found as little favour, as fruit eaters, as did a large proportion of the finch tribe from their abundance and being essentially grain eaters. One honourable gentleman, I understand, objected to the cuckoo on account of its "noise;" and that busiest of insect hunters in all stages of development, the little blue tit, was passed over on the charge of picking holes in wall fruit, his accuser, no doubt, having seen him in active search after the earwigs and ants, that, together with the wasps, had done all the mischief.

So much, then, as to the history of the transformation which Mr. Johnstone's bill experienced under the sentimental influences of Mr. Herbert's "suggestion." I would ask, however, in common fairness, that whatever ridicule may attach to "The Wild Birds'

Protection Act"—that "silly bill," as it was commonly termed in the House of Commons last session—may not be visited upon the promoters of the "Wild Fowl Protection Bill," who are in no way responsible for its altered title or provisions; whilst they have the mortification of finding their chief object, viz.—the protection during the breeding season of such wild fowl as have a marketable value—all but defeated by the alterations made in the penal clauses. That much undeserved censure has already been passed upon them, I am well aware, but will content myself with citing one ease in point. An article appeared in *Land and Water* for July 20th, 1872, in which the writer, after deprecating the omission from the schedule of the lark and blue titmouse, remarks, "The omission of some other birds implies sad ignorance on the part of the promoters." Now, unfortunately for this individual, (who, writing for a sporting and natural history journal, should have been an authority,) he objects not only to the "Wild Birds" but to the "Sea Birds'" Protection Act, on the ground that eggging is prohibited, as well as the slaughter of the parent birds. The fact, however, that an eggging clause, originally inserted in the Sea Birds' bill, was thrown out in the House of Lords, and that no such clause ever formed part of the Wild Fowl Protection bill, flings back the charge of ignorance upon this anonymous critic, who stands further convicted of having thus written without troubling himself to read either of the Acts in question.

As I stated last year, my opinion has always been that no Wild Fowl Protection Act will prove effectual without some provision for preserving eggs * as well as birds, local records too plainly indi-

* It does not appear to be generally known that under an Act passed in the reign of William IV., (1 and 2 William IV., c. 32, s. 24,) a penalty attaches "for destroying or taking eggs of game, &c.," by which it is enacted that "if any person *not having the right of killing the game upon any land, nor having permission from the person having such right* shall wilfully take out of the nest or destroy in the nest upon such land the eggs of any bird of game, or any swan, wild duck, teal, (including the garganey, of course), or widgeon, or shall knowingly have in his house, shop, possession, or control, any such eggs so taken, every such person shall on conviction thereof before two justices of the peace, forfeit and pay for every egg so taken or destroyed or so found in his possession, &c., such sum of money not exceeding 5s., as to the said justices shall seem meet, together with the costs of the conviction.

cating that a system of indiscriminate egging in our Broad district has been one of the main causes of the extermination of certain species. Again, although I regard any Act to protect small birds in this country during the nesting season (with some few exceptions) as wholly uncalled for, the permitted robbery of their eggs, as hitherto, seems to me an anomaly, since, unquestionably, the hedge-sparrow, thrush, blackbird, and others, suffer infinitely more from the egger than the gunner at that time of year; nevertheless, in such cases, I should regret indeed to see the law set in force for the arrest of every thoughtless bird-nesting urchin in our rural districts, whose depredations should be checked by other influences. Not so, however, on our broads and marshes, where the egg stealers are a very different class. Men, who either trespass in search of eggs, or take advantage of their occupation, in likely localities, to hunt for and secure them, well knowing their market value, and where best to dispose of them. With the prices now offered by dealers for the eggs of the bearded tit, how can we look for an increase in that species by protecting the birds alone? Or if the nesting bittern escapes the gun, what marshman could resist the temptation (no penalty attaching to the act,) of securing its literally golden eggs.

The close time, as fixed under the present Act, extends from the 15th day of March to the 1st of August, but whilst the 1st of March, like the 1st of April, in the "Sea Birds' Protection Act," would have been easier to remember, and in accordance also with the 1st of September and 1st of October, the commencement of partridge and pheasant shooting, it would have been none too soon to protect the earlier breeders; and if, as I presume, one of the main objects of the Act as regards wild ducks, snipes, and woodcocks, is to encourage them to nest with us in larger numbers, then, undoubtedly, the gunners' privileges should cease with the very beginning of March.

The most serious alteration, however, if we compare the provisions of the original Wild Fowl Bill with those of the present Act, will be found in the penal clauses, by which I fear, as they now stand, the Act itself will be rendered almost a dead letter. In Mr. Johnstone's bill, framed after the Sea Birds' Act, and looking to the recognised market value of the birds inserted in the schedule, the penalties were equivalently assessed, and the offender

was to forfeit and pay for every wild fowl killed, wounded, or taken, "such sum of money not exceeding £1, as to the justices or sheriff shall seem meet, *together with the costs of the conviction*:" but with the introduction into the schedule of the robin, hedge-sparrow, *et id genus omne*, arose, no doubt, an impression in the minds of the Committee, that the same penalties would be quite disproportionate in the case of such "small deer," and consequently, that most important clause now enacts that any offender against the Act, shall "for a first offence be reprimanded and discharged, on payment of costs and summons, and for every subsequent offence forfeit and pay for every such wild bird so killed, wounded, or taken, or so exposed or offered for sale, such sum of money as, *including costs of conviction*, shall not exceed five shillings, as to the justices or sheriff shall seem meet." Now this, I imagine, so far as the majority of the small birds is concerned, will result in a total absence of prosecutions, whatever cases may occur, in the "close time," of their being "killed, wounded, or taken;" and as regards the rarer species, whether of wild fowl or song birds, even though prosecutions may be occasionally instituted, I am far from hopeful as to the deterrent effect of a *reprimand with costs*, for the first offence, or a 5s. penalty and costs, for any subsequent conviction, upon the class of men most likely to transgress the law. Will Lady Coutt's nightingales be more secure, though an Act has been passed in their favour, whilst any birdcatcher (who in all probability would not be taken for his *first* offence,) can make a sovereign at least of every male bird that he succeeds in getting well on to food in confinement, and can afford, therefore, to risk subsequent convictions at the rate of 5s., including costs?

I can foresee, also, in cases of prosecution, some little difficulty in identifying species, owing to the number of provincial names attached in different localities to some of our smaller British birds. In Mr. Johnstone's bill, birds having various aliases were entered two or three times over under different synonymes, as, for instance, the common dunlin appeared also under the name of oxbird, purre, plover's-page, and stint; but with the birds subsequently added, this course was not adopted, and it may, therefore, become a nice point of law, whether a man brought up for killing a hedge-sparrow, and who asserts that he never heard of such a bird, but that what he killed was a "Dickey Dunnoek," (a North country

term for the same, but not in the schedule,) would be liable to conviction? In proof of the difficulties attending this part of the question, I have appended to these remarks an alphabetical list of the birds included in the schedule, to which I have added, in brackets, the most common provincial terms by which they are known in England and Scotland.

- AVOCET [*Shoehorn, Yelper, Clinker*], BITTERN [*Bottley-bump, Mire drum, Bog bumper*],
 BLACKCAP [*King Harry blackcap*], CHIFFCHAFF [*Chip chop*],
 COOT [*Bald coot*], CREEPER [*Tree creeper*], CROSSBILL [*Shelapple*],
 CUCKOO [*Gowk*], CURLEW [*Whaup,* Whitterick*], DOTTEREL [*Foolish dotterel*],
 DUNLIN [*Sea snipe, Oxbird,* Plover's page,* Purre,* Stint **],
 FLYCATCHER [*Wall, beam or bee-bird*], GREENSHANK,
 GODWIT [*Yharwhelp or yarwhip, Godwyn, Poor willie*],
 GOLDEN-CRESTED WREN [*Marygold finch, Tidley goldfinch*],
 GOLDFINCH [*Draw-water, Goldie, King Harry redcap, Goldspink, Thistlefinch*],
 HAWFINCH OR GROSBEAK, HEDGE SPARROW [*Hedge warbler, Dickey, Dunnock, Winter fauvette*],
 KINGFISHER, LANDRAIL [*Corn-crake*], LAPWING [*Pewit,* Peeseweep, Green plover*],
 MALLARD [*Male of Wild Duck*], MARTIN,
 MOOR OF WATER HEN, NIGHTINGALE,
 NIGHTJAR [*Fern owl, Goat-sucker, Churn owl, Night chur, Wheel-bird, Dor-hawk*],
 NUTHATCH [*Nut-jobber, Nut-cracker*], OWL, PHALAROPE,
 PIPIT [*Titlark, Grey-cheeper, Moss-cheeper, Titling*], PLOVER,
 POCHARD [*Dunbird*],* QUAIL, REDPOLE, REDSHANK [*Red leg, Pool snipe, Sandcock*],
 REDSTART [*Redtail, Firetail*], ROBIN REDBREAST,
 RUFF AND REEVE, SAND GROUSE, SANDERLING,
 SANDPIPER [*Summer snipe*],*
 SEALARK [*Stonehatch,* Ringed plover, or Dotterel*],
 SHOVELLER [*Spoonbill*], SISKIN [*Aberdevine*], SNIPE,
 SPOONBILL, STONE CURLEW [*Thicknee,* Norfolk plover*]
 STONECHAT [*Moor titling*], SWALLOW, SWAN, SWIFT [*Devlin screamer, Black martin*],
 TEAL, TITMOUSE LONG-TAILED [*Bottle tit, Long-tailed pie, Poke pudding, Mun ruffin*],
 TITMOUSE BEARDED [*Reed pheasant*], WAGTAIL [*Dishwasher, Quaketail*],
 WARBLER DARTFORD, WARBLER REED,
 WARBLER SEDGE [*Sedge-bird, Reed fauvette, Blethering tam*],
 WHEATEAR [*Fallow smich, White-rump*],

WHINCHAT [*Furze chat*], WHIMBREL [*May bird, Half curlew, Curlew jack, Tang whaap*],
 WIDGEON [*Smee*], WOODCOCK,
 WOODLARK, WOODPECKER [*Rain-bird, Hew-hole, Woodspite, Yaffel, Popinjay, Witwell*],
 WREN [*Jenny wren, Kitty wren*],
 WOOD WREN [*Willow warbler, and Wood warbler*],
 WRYNECK [*Cuckoo's mate or leader, Snake bird, Emmet hunter*].

*Those marked with an * are included in the Schedule, but are Synonymes only, and not distinct species, as in the case of the Dunlin, which is entered under four other names. The Schedule thus includes 69 distinct species, and 10 Synonymes.*

N.B.—Tho words Flycatcher, Martin, Owl, Plover, Pipit, Sandpiper, Teal, Wagtail, Woodpecker, and Wood Wren, include such species of each class or family as breed in this country.

VII.

MISCELLANEOUS NOTES AND OBSERVATIONS.

MAMMALIA.

BY T. SOUTHWELL.

WATER SHREW (*Sorex fodiens*, Pall.)—In my list of Norfolk Mammalia, read before this Society in February, 1871, I stated that I could not claim this species as a Norfolk animal from my own observation, or on the authority of any of my correspondents; as both Messrs. Paget and Mr. Lubbock mention it in their lists as found in Norfolk, although rather rare, and as every probability seemed to be in favour of such being the case, I included it on their authority. Since Messrs. Paget's list, dated 1834, and Mr. Lubbock's, so long back as 1845, I have seen no notice of its occurrence. Although for some years constantly on the look out for this pretty little shrew, it was not until September last that I was rewarded with success. Those who were present will remember with pleasure the excursion made by this Society to South Walsham and St. Bennet's Abbey, on the 11th of September, 1872; it was as we were returning to our boats, after inspecting

the Abbey ruins, that I found the remains of a shrew upon the river's bank, which I at once recognised as an individual of this species. Although so long dead as to render it impossible to preserve it as a specimen, the beautiful silvery white of the under parts with its well defined boundary, together with other minor distinctions, left no doubt as to its species. It affords me great pleasure to be able to record a recent instance of the occurrence of this species; for although I am strongly of opinion that it is more frequent than is generally supposed, it is extremely difficult to meet with.

OARED SHREW (*Sorex remifer*, Geoff.)—Through the kindness of Mr. F. Norgate, of Sparham, I am enabled to record the occurrence of this shrew at Sparham, where it was found dead in the rectory garden, on the 7th of October. Some years ago Mr. Norgate found an oared shrew in the same garden; it was dead, and near it lay a common shrew. The specimen which I now exhibit differs somewhat from any which I have previously seen, particularly in the absence of the reddish yellow patch under the throat; Professor Bell, however, who has examined it, considers the tuft of white hairs at the ears, as well as other less obvious characteristics, quite sufficient to identify it with *S. remifer*. The cilia which fringe the feet and under surface of the tail have now dried close to the skin, but when fresh were quite obvious. This species was first described as British in Sowerby's *Brit. Misc.* (p. 49), under the name of *S. ciliatus*, from a specimen found in Norfolk by the late Sir Wm. Hooker. In the number of London's *Mag. of Nat. Hist.* for September, 1832, Mr. Yarrell describes a shrew which he says is probably identical with Sowerby's *S. ciliatus*; he objects to the specific name, as indicating a character possessed alike by all the water shrews, and shows it to be the same species as the continental *Sorex remifer*. Since Sir Wm. Hooker's, I know of seven other Norfolk specimens; I am inclined to think, however, as I remarked of the water shrew, that a sharp look out would prove it to be a far more common species than is generally supposed. The first time I met with it was in 1855, at Fakenham, where I shot one in a shallow stream of water, as it ran along the gravel at the bottom; Mr. Yarrell saw this specimen and identified it. *Oct.*, 1872.

NOTE. Since the above was communicated I have obtained two other specimens, both of which differed from the normal type of either *Sorex fodiens* or *remifer*. The upper part in both instances was nearly black, the under being iron grey with no trace of the chesnut throat. Professor Bell kindly examined one of these for me, and pronounced it to be a variety of *S. fodiens*. He also informs me that many others have been observed intermediate between the normal water shrew with the under part pure white, and the so-called oared shrew with that part nearly as dark as the back, and that it is now believed *Sorex remifer* is merely a variety of *S. fodiens*.

ORNITHOLOGICAL NOTES FOR 1872—3.

BY H. STEVENSON.

SNOWY OWL (*Surnia nyctea*.) Since the occurrence of the immature bird of this species, noticed in our *Transactions* for last year, a hitherto unrecorded Norfolk specimen has come under my notice. This example, also in immature plumage, is now in the possession of the Rev. W. G. Wilson, of Fornsett St. Peter, who has kindly furnished me with the following particulars. It was first seen by him twenty-five years ago, at the house of the late Rev. F. Bevan, of Carleton Rode, by whom he was informed that it had been shot in that parish some years before; and he subsequently purchased the bird at the sale of Mr. Bevan's effects. The Rev. Thomas Fulcher, of Old Buckenham, an old friend of Mr. Bevan's, also remembers his stating, on more than one occasion, that this owl was shot at Carleton Rode; and whilst he is certain that it was not in Mr. Bevan's possession when he made his acquaintance, in 1824, is inclined to fix the date of his first seeing it about the year 1830.

DIPPER (*Cinclus aquaticus*.) A specimen of this accidental visitant to our coast is recorded by Mr. J. H. Gurney, in the *Zoologist*, s.s., p. 3103, as having been shot by Mr. R. W. Ketton, (in whose possession it now is,) at the side of a pond, in Felbrigg Park, on the 18th of April, 1872. This bird, like nearly all that I have examined, killed in this county, has the black breast of

the Scandinavian form, answering to the *Cinclus melanogaster* of Gould. That the Scotch type, however, with a rich chesnut band on the lower part of the breast, has also occurred in Norfolk, I have no longer any doubt. Since writing my account of this species in the *Birds of Norfolk*, I have had the Muscum specimen, which, according to Lubbock, was killed at Hellesdon Mills about the year 1845, carefully cleaned, and this has developed the chesnut band most satisfactorily. Mr. E. S. Preston, of Yarmouth, in whose collection (recently dispersed) was the dipper, formerly in the possession of Mr. Youell, of Yarmouth, and recorded by Messrs. Paget as killed at Burgh, in November, 1816, assures me that this bird* has also a red breast, as have a pair given me by Mr. Preston, said to have been killed near Yarmouth about the year 1868; but as to the history of the two latter I am very doubtful. The date of the Felbrigg specimen is unusual, as the dipper almost invariably visits us during the winter months, between November and February.

WOODCOCKS NESTING. The following notices of woodcocks' nests, found in this county, in the spring and summer of 1872, proves that protection only is needed, to induce many of these birds to become residents in our woods and plantations. Early in April, a nest and four eggs were found on the estate of Mrs. Lyne Stephens, in the parish of Lynford, and a second pair of birds, observed at the same time, were believed to have a nest in that neighbourhood. On the 7th of May two young woodcocks were found in "Harrison's brake," at Felbrigg, and about the same time, another nest was found in the Hercules wood, at Blickling, as recorded by Mr. J. H. Gurney, jun., in the *Zoologist*, s.s., p. 3133. The same gentleman received one alive, but with one wing broken, which had been picked up on the 22nd of July, under the telegraph wires at Roughton, near Cromer, and he has since learnt that another, possibly its mate, had been seen throughout the summer at Gresham, in that neighbourhood. In a note in the *Field*, of May 25th, Lord Kimberley also says, "Four woodcocks were hatched in one of my woods this spring; when last seen, they were able to fly."

* Now in the collection of the Rev. C. J. Lucas, of Burgh.

BLACK REDSTART (*Phœnicura titlys.*) An adult male of this species was observed by Mr. Howard Saunders, on the 15th of May, in a field by the side of the Cromer road, near the Erpingham tollbar. This species is decidedly rare in Norfolk; an adult male, in my own collection, killed at Hoveton, in March, 1870, and some three or four females, procured at Yarmouth in 1848 and 1849, being, I believe all that have hitherto been identified in this county. The appearance of the two males in spring, and the females in October and November, is somewhat remarkable.

OCCURRENCE OF THE CONTINENTAL COAL TITMOUSE IN NORFOLK. Messrs. Sharpe and Dresser, in their new and exhaustive work on *The Birds of Europe*, have recently pointed out the specific distinctions existing between the European coal titmouse, the true *Parus ater* of Linnaeus, and the coal tit of the British islands, for which they now propose the scientific appellation of *Parus britannicus*. That the continental form occurs occasionally in this country was ascertained by the authors, through the examination of two Norfolk killed specimens, in the collection of Mr. J. H. Gurney, jun., one procured at Northrepps in January, 1866, and the other at Lakenham, near Norwich, in the spring of the same year. That the continental coal tit, as now distinguished from our own familiar species, will be found, by careful observation, to be a winter visitant to other counties in England as well as to our eastern coast, is not less certain, I think, than that further research will prove it to be an annual migrant from the Scandinavian forests; but it has yet to be ascertained whether the British coal tit, at present met with only in this country, ever migrates to the Continent during the winter season. The true *Parus ater* is generally distributed throughout Europe, but is more abundant in the northern parts, and like most allied continental forms, differs, chiefly, from our insular species, in the more vivid tints of its plumage; it is also slightly larger in some of its measurements. The chief distinctions in plumage, as given by Messrs. Sharpe and Dresser, seem to be that, in *Parus ater* the back is "a clear slaty blue," in *Parus britannicus* "greyish, with a strong wash of yellowish olive," and in the former, the buff colour of the flanks has a richer vinous tint. This discovery adds a new species to the Norfolk list.

GREY-HEADED YELLOW WAGTAIL. A female of this species, the *Motacilla neglecta* of Gould, which has occasionally, but rarely, been met with in this county, was procured by Mr. Gunn, on the 30th of April last, by the river side at Heigham, Norwich.

OCCURRENCE OF THE ALPINE SWIFT (*Cypselus alpinus*) IN NORFOLK. A specimen of this fine swift, a straggler from Southern Europe, was killed on the 9th of September, by a man named Alfred Andrews, as it flew over the long marsh at the back of Breydon Wall, and is now in the possession of Mr. J. Overend, of Yarmouth, to whom I am indebted for the above particulars. No other swifts were observed at the time. But one other example of this species is known to have been killed in Norfolk, which was shot in the parish of Old Buckenham, in the latter part of September, 1831, and recently presented to the Norwich Museum by the Rev. Thomas Fulcher. On the Suffolk coast, Mr. N. F. Hele, of Aldeburgh, recorded in the *Field*, of September 17th, 1870, the capture of an immature specimen in a room of the Brudenhall Hotel, at Aldeburgh, which, with a companion that escaped, had been seen fluttering against the window. I may here add, that on two occasions during the last week in June, 1871, I remarked a gigantic swift, in flight with others of the ordinary species, passing over my garden close to the city, and which I believe to have been of this species. Mr. H. M. Upcher also informs me, that on the 5th of October of this year, a supposed Alpine swift was seen at Sherringham.

AMERICAN WHITE WINGED CROSSBILL (*Loxia leucoptera*.) (Gmelin.) On the 9th of October, 1872, Mr. John Henry Gurney, junior, purchased alive, of a man named Harvey, at Yarmouth, (son of the noted game dealer of that name, mentioned by Messrs. Paget,) a female example of this crossbill, which, until recognised by Mr. Gurney as a rarity, had been taken for the common species. According to Harvey's account, it was caught on the rigging of a vessel named the Beecher Stowe, which arrived at Yarmouth in October, 1870. It was then in a wretched state of plumage from close confinement, but had since been kept as a pet by Harvey, and was extremely tame. Yarrell, who included both this and the European white winged crossbill, (*Loxia bifasciata*, Nilsson),

(which has also occurred in this county,) in the 3rd Ed. of his *British Birds*, gives but one instance of this American species having been recognised in England—a male found dead on the shore at Exmouth, on the 17th of October, 1845; and I am not aware that it has been met with since. Whether Mr. Gurney's bird came on board the *Beecher Stowe* in mid-ocean, or near land, is not known, but being still alive when brought ashore, though in so deplorable a condition, it could not, I think, have been long before the arrival of the vessel in port. Mr. Gurney has very kindly placed this most interesting bird in my aviary, where, like other crossbills, it climbs over the wires, after the manner of a parrot, by aid of its bill and feet, and feeds out of the hand with perfect confidence. In drinking from a shallow pool it lays its head down sideways and thus sips the water, without inconvenience from its crossed bill, a peculiarity I have never seen recorded of the crossbill tribe. It is not an unusual circumstance, I understand, for common crossbills, caught on board smacks and coasting vessels, to be brought into Yarmouth.

LAPLAND BUNTING (*Plectrophanes lapponica*.) I last year recorded the occurrence, in Norfolk, of a bird of this species, a somewhat rare visitant from Northern Europe, and have now to mention an hitherto unrecorded specimen, purchased by Mr. Gurney, of Harvey, at the same time with the American crossbill. This example, an adult male, in part change from summer to winter plumage, was netted in the "Californian Gardens," at Yarmouth, in the autumn of 1868, and was kept alive by Harvey for three years when, dying during the moult, it was stuffed by him as it now appears.

HAWFINCH (*Coccothraustes vulgaris*.)—The mild winter of 1872-3 has been as remarkable for a large influx of this species as the severe season of 1859-60; and though it is to be feared that many of our home bred birds are amongst the slain, still their simultaneous occurrence in more southern counties, as well as in Suffolk, would seem to indicate a very considerable migratory movement. The time of their appearance also corresponds to that of previous seasons, extending from the beginning of December to the first week in March, and although the larger number have been

killed, as usual, in our enclosed districts, where, for both residents and migrants of this species, old yew trees and gardens stocked with bullace trees have most attractions; a few have been procured on the coast at Yarmouth, as in 1859, when a large flight alighted in the gardens facing the Denes. On this occasion a considerable proportion of the specimens brought to our bird-stuffers, have been killed in and around Diss, and chiefly in one particular garden in the town itself. The number destroyed in that locality alone is variously estimated at between fifty and sixty, of which about thirty were shot at Diss. Of other examples brought into Norwich to be preserved, I have seen ten from East Carlton, one Buxton, two Bergh Apton, two Kirby, two Arminghall, four Lyng, three Brooke, two Hethersett, and one Catton, twenty-seven in all; and these probably represent but a portion of the birds sacrificed when attacking the bullaces in market gardens. Mr. Thos. Southwell informs me that in all the Diss specimens, the contents of whose stomachs were reserved for him to see, "the food consisted entirely of yew berries; but those from East Carlton and other villages near Norwich, had, in every instance, been feeding on the kernels of a small stone fruit, probably the bullace, as they were seen to frequent those trees. In dissecting them a very powerful smell of prussic acid was evolved from the partially decomposed kernels." The Rev. H. T. Frere, of Burston, received a nestling hawfinch in the spring of 1872 bred in that neighbourhood, and every year adds more instances of this species remaining to breed both in this and the adjoining county.

WAXWING (*Bombycilla garrula*).—That the appearance of waxwings on our Eastern coasts during the winter months is not due, as a rule, to the severity of the season, is shown by the appearance of many examples in the present winter of 1872-3. Between the 15th of November and the 8th of February, I have notes of some sixteen examples killed in different parts of the county, in date about equally distributed over the period before and after Christmas. The majority of those I have examined have been in remarkably fine plumage, some having four, six, and seven wax tips on each wing, but none eight, as I have seen on previous occasions; when the number of tips is uneven I have frequently found the deficient quill showing traces of friction or

other injury. In the most adult birds the yellow markings on the outer webs of the primaries are carried round the tip of each feather, with a more or less clearly defined white edging. One bird killed this season, a female by dissection, differs from any I have ever seen, (though I have handled more than a hundred freshly killed specimens at different times,) in having no wax tips at all even in the most rudimentary state; I believe the bird from its general appearance to be a young female, but as even the nestlings are known to show this peculiar feature, this is no question of age; nor can I positively state any reliable distinction between the sexes, short of dissection; young males and females and adult males and females, being, relatively, so much alike. Yarrell's statement that females have never more than five wax tips, is inaccurate, as I have dissected specimens with six and seven in each wing; the yellow and white markings on the primaries, being, in these birds, as fine as in any adult male. By far the larger number of the birds killed here this winter, have proved to be males. Besides a few stragglers, we have had no waxwing years since the memorable winter of 1866-7, when between the 17th of November and the 7th of January, 144 specimens were killed, to my knowledge, in Norfolk only, and their abundance was noted in many other counties. Throughout that time the weather was extremely severe. Mr. Thos. Southwell when dissecting several of those recently sent to Norwich for preservation, found, in the stomachs of all but two, the remains of white-thorn haws; the exceptions had been feeding on privet berries, the whole intestinal canal being stained a rich purple.





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1873—4.

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H.

Hamond Capt. Philip, R.N., *Mouse-
hold House*

Hamond Charlos, *Mousehold House*

Hancock T.

Harcourt W. B.

Hardingham F., *Fakenham*

Harmer F. W., F.G.S.

Hills W. C., M.D., *Thorpe Asylum*

Hodgson Mrs.

Hooker J. D., M.D., C.B., President
R. S., *Royal Botanic Gardens, Kew*

Hoso Rev. T. C., *Roydon, Diss*

Howos J.

K.

Kent A.

Kitton F., *President*

L.

Laurence Rev. J. A., *Dilham*

Lowe John, M.D., *Hon. Mem., Lynn*

Lubbock Rev. Richard, *Hon. Mem.,
Eccles Rectory*

Lynn Natural History Society,
President of, *Hon. Mem.*

M.

Manning Rev. C. R., *Diss Rectory*

Marsham Rev. H. P., *Rippon Hall*

Martineau Miss, *Bracondale*

Master A.

Morgan A. M. F.

Mottram A.

Muriel C. E.

N.

Newcome F. D'Arcy, *Feltwell Hall*

Newton Professor, F.R.S., *Hon. Mem.,
Magdalen Coll., Cambridge*

O.

Orfeur J.

P.

Parker J.

Partridge Rev. W. H., *Rickingham
Superior*

Pigott T. Digby, *Sherringham*

Pinder T. Richmond

Plowright C. B., *Hon. Mem., Lynn*

Purdy R. J. W., *Woodgate House,
Aylsham*

R.

Reovo J.

Robbins Miss

Robinson H. S.

S.

Solf A. C.

Shaw James, M.D., *Thorpe Asylum*

Smith W.

Sothorn S.

Southwell C., *Gurrey Lodge, Hendon,
N.W.*

Southwell T., F.Z.S., *Hon. Sec.*

Squirrel M. P.

Stannard R.

Stevenson H., F.L.S., V.P.

Stracey Miss, *Rackheath Hall*

Sutton Francis

Sutton Frederick

T.

Thursby Rev. W. F., *Bergh Apton*

Thwaites C., *Thorpe Hamlet*

Tracey Rev. F. F., *Beccles*

Turner Horace

U.

Upcher H. M., F.Z.S., *Sherringham
Hall*

Utting S. W., *Thorpe Hamlet*

W.

West A., *Wymondham*

Wheeler Rev. T. A.

Wheeler F. D.

White R. W.

Wild Edward

Williams C.

Wilson G.

ADDRESS

Read by the President, MR. FREDERIC KITTON, to the Members of the Norfolk and Norwich Naturalists' Society, at their Fifth Annual Meeting, held at the Norfolk and Norwich Museum, March 31st, 1874.

LADIES AND GENTLEMEN—I must, in the first place, thank you for the kind forbearance you have shown towards my many shortcomings during my Presidency.

I accepted the honour with considerable reluctance, as I was fully aware of my unfitness for the position in which you placed me. You will, perhaps, remember, when I accepted the Presidency of this Society, I stated that my studies had been chiefly of those minute forms of life which require the assistance of the microscope even to see them, and the highest powers of the instrument to study their details.

This branch of natural history, unfortunately for myself, does not come under the cognizance of this Society; if it had I might have passed through my year of office more to my own satisfaction. I hope in future years the study of microscopic life may find a place in our programme. (The Leeds Naturalists' Field Club has formed a section for microscopic investigation, and an excellent microscope for the use of the members has been purchased by subscription.)

In accordance with the custom of this and other Societies, I now proceed to call your attention to the papers and lectures given during the past session, and I cannot help expressing my regret that so little has been done in that direction during my official year. I find on looking through our minute book, that only seven papers and two lectures have been given during the last twelvemonths; this, I think, is not creditable to a Society numbering some 120

members, and I hope my successor will be able to report more favourably at the termination of his year of office.

The first of the two lectures given by the Rev. J. Bates, consisted of his observations on the planet Mars, which during the earlier portion of last year, was in a more than usually favourable position for observation. The reverend gentleman was listened to with much interest by the members present, and a discussion took place on the probable physical condition of the planet as deduced from his telescopic appearance. The second lecture consisted of a brief but lucid description of the methods about to be used for the observation of the forthcoming Transit of Venus: both lectures were illustrated by diagrams. Although these subjects belong rather to physical than biological science, they were listened to with much interest.

We are indebted to Mr. Wheeler for a paper on Breeding Lepidoptera in confinement. This paper was of perhaps more than usual interest, containing as it does many natural history facts. The breeding and rearing these forms in confinement, seems to me to be of much more importance than mere collecting, as it affords ampler means of studying the amount of variation and the changes produced by external conditions than the capture of a large number of specimens in the ordinary manner. As this paper will be published in the current part of our transactions, I will not occupy your time by a more detailed description of its contents.

Mr. Bridgman read a short paper on the nesting of a British bee (*Prosopis*,) formerly supposed to be parasitic. I also find that he has given a second and more elaborate paper on "British Bees," describing their classification, habits, and physical structure. This class of insects seems to have received but little attention from naturalists, and the popular knowledge of them is probably confined to some two or three species; I am therefore glad to find that Mr. Bridgman is still assiduously studying them.

Mr. Geldart has given us a short but able *resumé* of Sir John Lubbock's valuable monograph of Colembela and Thysanura, in which he (Mr. Geldart) called the attention of the members to the fact that the author agrees with Brauer, that the genus Campodea

retains the form of the primitive insect stock from which most if not all of the present order of insects have diverged in different directions, and to a greater or less degree.

Fritz Müller, in his "Für Darwin," expresses the opinion that there were perfect insects before there were larvæ or pupæ. This Sir John doubts, holding that the first stage of the primitive insect was an apod fleshy vermiform grub. Sir John also differs from Meinert, who holds that Campodea retains its larval form all its life without undergoing any metamorphosis, while Sir John considers that it emerges from the egg in the form of a perfect insect, thus escaping any necessity for metamorphosis.

The difficulties relating to the formation of the mouth in insects are overcome in Sir John's opinion by the intermediate form of that organ in Thysanura, which might develop in one direction into the Suctorial, and in the other into the Mandibulate type.

Mr. Geldart pointed out that two difficulties seemed to him to remain untouched—viz., that if the original insect stock had no metamorphosis, but emerged from the egg perfect, it was difficult to conceive how the process of metamorphosis ever originated; whilst on the other hand, if the normal growth of insects required metamorphosis, it was still more difficult to understand how the intermediate stages could ever be lost.

Botany has been very poorly represented this year. Mr. Corder gave us one very short paper on the botanical characters and medicinal properties of Podophyllum, and a second was read by your President on the Fly fungus (*Empusa musca*.)

The occurrence of *Limulus polyphemus* off the coast of Holland, has been noticed in a paper read by our Honorary Secretary Mr. Southwell, in which he calls attention to the fact that this form is coeval with the Trilobites. He also described at some length, the remarkable structure exhibited in this singular crustacean. At the February meeting, Mr. Southwell read an extract from a paper by Mr. W. A. Lloyd, of the Crystal Palace Aquarium, which dispelled the mystery of the occurrence of this species so far from its normal habitat.

Mr. Lloyd, writing to the "Zoological," for February, 1874 (see

p. 3845,) states that in the year 1866, he was engaged in the Hamburg Aquarium, and obtained from New York and its neighbourhood, many more King Crabs than he could accommodate in that institution, or succeed in disposing of otherwise. Unwilling to destroy them, he conveyed them on board one of the London steamers, with instructions to a man on whom he could depend, to "throw them all overboard when the steamer got fairly into salt water a little on the British side of Heligoland." This he had evidence was faithfully done, so there can be little reason to doubt that those caught off the coast of Holland are the same introduced by him in August, 1866, or some of their descendants.

Milne Edwards has been recently investigating the circulating apparatus of *Limulus*, and he says that it is more perfect and complicated than that of any other known animal; the venous blood circulates for a considerable distance enclosed in vessels with distinct walls separating them from the adjacent organs.

Whilst regretting the few papers that have been placed before us this year, I am glad to find that the Transactions will not be less valuable on that account. We are able to publish two very important additions to our Fauna and Flora of the county—viz., a list of Norfolk fishes, with remarks and introduction by Dr. Lowe, of Lynn; and an elaborate descriptive catalogue of the Norfolk Lepidoptera, by Mr. Barrett. We have, I think, much reason to congratulate ourselves on obtaining the assistance of two gentlemen, whose names are a sufficient guarantee of the correctness of their respective lists. Mr. Barrett's list, which is very complete, and is published as an additional part, will, I have no doubt, be eagerly sought after by those interested in the study of the Lepidoptera, and probably induce many to visit us in the hope of obtaining some of the rare forms which find a habitat in this county. I cannot help expressing my great regret (and I am sure yours also,) that Mr. Barrett will no longer be able to give us his valuable assistance as heretofore; in losing him the Society has lost a member who cannot soon be replaced. I must also congratulate this society on the publication (by permission of the Meteorological Society,) for the first time in our Transactions, of

the Summary of the Meteorology of Norwich ; and our thanks are specially due to Mr. John Quinton, jun., their registrar, for a condensed summary of the reports for the past four years.

Our excursions have been more than usually successful : that to Costessy Park, by the kind permission of Lord Stafford, was attended by upwards of thirty members.

The visit to Herringfleet Hall and Fritton Decoy, by the kind invitation of Lieut.-Col. Leathes, was also numerously attended, and was thoroughly enjoyed by the visitors.

The visit of the Society (by invitation of J. H. Gurney, Esq.) to Northrepps Hall and Cromer, was replete with interest ; the fine ornithological collection at the hall was inspected under the guidance of Mr. J. H. Gurney and his sons, who spared no pains to make the visit interesting and instructive.

As something more than a brief *resumé* of the year's work is expected in a Presidential address, I perhaps cannot do better than make a few remarks on a subject which has of late years disturbed the biological world—I mean spontaneous generation. The doctrine of spontaneous generation is no new thing. Many centuries ago, the sudden appearance of certain organisms was attributed to spontaneous generation, but when more accurate observations were made, it was found that the supposed spontaneously produced forms were, after all, generated from seeds or eggs ; the microscope has also helped to dispel many erroneous notions in connection with that theory.

The belief in spontaneous generation, or Abiogenesis, for many years nearly extinct, was revived by some French Savans. Pasteur, for example, who conducted many experiments in a much more careful manner than had ever been done before, and with results that seemed to prove that life might originate *de novo*, from that which had no life. The opponents to Abiogeny repeated the experiments with still greater care, to exclude the presence of species, and found that living organisms now rarely made their appearance, but there was no doubt that they were occasionally to be detected after the most careful manipulation ; thus the battle has raged between Panspermia and Abiogenesis. Dr. Bastian,

who may be fairly termed the champion of the latter theory, has made innumerable experiments with even greater care than any of his predecessors, and with results that seem to prove that life may originate *de novo*.

Unfortunately his experiments are repeated by Ray Lancaster and others, every precaution being taken to exclude or destroy any germs that might produce living organisms, and the result is the total absence of all life; thus the settlement of the question as to the production of life, *de novo* or *ab ovo*, seems as remote as ever.

The fact of the evolution of the more highly organized from the simpler forms of life, seems at first sight to be of far easier proof than that of Abiogenesis. The thin pellicle which forms on the surface of fluids, in which animal or vegetable matter has been macerated, affords an opportunity for continuous observation, and Dr. Bastian has made various experiments, which seemed to show that vibrios bacteria and monads did develop into higher forms, but other experimenters have not been so successful. It seems to me quite possible that the decay of the simpler organisms may have formed a suitable pabulum for the growth and development of the higher forms, as the decay of the lichens and mosses on the barren rock, has enabled the spores of ferns and seeds of grasses to obtain foothold, they in their turn have decayed, and thus conducted to the growth of small trees and shrubs, and lastly of large trees; this is no fanciful supposition, but what we know to be now taking place on the coral reefs and islets of the Pacific; arguing from analogy, it would be as reasonable to suppose that the gigantic palms with which some of these islands are clothed were developed from the mosses and lichens that first occupied the dry land as to imagine that the rotifers, &c., were developed from the vibrios and monads of the proligerous pellicle.

Some very interesting and valuable experiments have been made by the Rev. W. H. Dallinger and Dr. Drysdale, on the growth and development of some forms of monad life, the results of which they have published under the title of "Researches in the Life History of a Cereomonad;" and as these results seem to have important bearings, not only on spontaneous generation, but also on the

doctrine of evolution, I do not hesitate to give a short *resumé* of their labours.

They remark that in studies of this kind, it is necessary that they should be made without a break in observation, through all the changes that the form under examination may undergo, and then by repeating the observations, decide on the stability or otherwise of the form. For work of this kind to be effective there must be more than one observer, in order that these observations may be unbroken as far as possible, and also to secure a mutual as well as a double confirmation. In order to carry out these observations, they employed an arrangement by which they were enabled to keep the same drop of fluid under examination from eight to fourteen days, when placed under the highest powers of the microscope. The form examined was obtained by macerating a cod's head for some months. The striking similarity of form and structure in all the extremely minute monads, makes distinction of form almost impossible, whilst the tendency of individuals to vary from the type form, makes it unsafe. But physiologically and morphologically the recurrent cycle of sequence is unerring.

The form of this monad is described by the author as being a long oval inclined to an egg shape; at the narrow end a sharp conical projection might be observed, and from it proceeds a delicate flagellum, about twice the length of the body; under this a longer flagellum may be detected, by means of which it is enabled to anchor itself. Its mode of increase, and at one time supposed to be its only one, is by fission, but by long and continuous observation, they detected the conjugation of the free form. The authors remark that "the form on which our constant labour had been bestowed, passed through a series of remarkable changes, all and every one of which might be taken for a distinct and independent creature, but that we have traced it through all its transitions, and seen it pass from one into the other. We find that these changes are always alike. The stability of their recurrence is as complete as that of any entomological form. But we had one very important investigation to complete. On this we were working with the highest powers, when our attention was arrested by

the appearance in the fold of a form very similar to the one with which we were so long familiar, but manifesting an entirely dissimilar behaviour.

“The new comer was, roughly speaking, like the old form in shape and size, but instead of two flagella at one end, it had a single flagellum at each end, and it was multiplying with great rapidity. Reasoning from what we knew, we felt assured that this was not a capricious development of our old friend, whose life history we had almost compassed.”

The form above mentioned was carefully watched, and fission was found to take place in the following manner. The first indication that it was about to take place was that the body became squarer, more plastic, and subamæboid; a slight but sudden constriction of the sarcode ensued, which gradually increased; at the last stage a stretching of the constricted part of the sarcode took place, the flagella lashing with great force. As the sarcode stretched it became finer, no more being extended from the now perfectly divided bodies, having reached its final length, the attenuated sarcode suddenly snaps. Taking an average of forty cases they found that this entire process was completed in about four minutes and forty seconds. The observers found that this mode of increase might continue without any change, for eight days at least.

Many of the organisms in question all at once appeared to be pouring out a delicate sarcode, nevertheless they moved with great freedom, the flagella rapidly vibrating, the sarcode increasing in size all round the organism, but was of extreme tenuity. In the course of seven hours there were several in the field moving in all directions, and at length two touched each other. A rapid blending of the sarcode now ensued, and the flagella disappeared; they were constantly watched, the amæboid sarcode of each blended with the other, and at length the bodies touched and began to unite. Their union was now rapid, and at length they became a mere cyst—with a very decided investment. Having reached this condition and become slightly yellow in hue, an apparent thinning of the integument of the cyst ensued. It became suddenly rent all round, and retracted towards the centre. Up to this time they had

employed a magnifying power of 2500 diameters. (I may perhaps make this amount of amplification clearer to my non-microscopic friends by asking them to imagine an object one inch in length subject to this enlargement, it would then be equal in length to 69 yards.) With this was perceived that the ruptured cyst was pouring out what at first sight appeared like a viscid mass, but when examined in a more dispersed condition, presented the appearance of minute granulation. Under a still higher power it became evident that a dense mass of granules inconceivably small, were being emitted from the cyst. This observation, being of great importance, was repeated with the same results. It now became desirable to study the future of those infinitesimal spores, which even with a power of 2500 diameters, were only visible from their enormous aggregation (the authors endeavour to give some idea of their minuteness by figures of other minute forms placed in juxtaposition. You will, perhaps, be able to form some notion of their extreme minuteness, when I tell you that a dot $\frac{1}{250}$ of an inch in diameter, would be visible to the unassisted eye, and these spores, when magnified 2500 times, were only visible when in masses.) After watching them without intermission for six hours, the granules were found to have gradually increased in size. After the expiration of nine hours the flagella were distinctly seen, and in somewhat less than twelve hours, the normal size of the parent form was attained, and in about forty minutes after fission began to take place. This continues from two to eight days, when everything as before described commences.

These observations are of great value, as they have determined the actual life history of some of those singular forms of life, and which were often supposed to be merely early stages of higher organisms; but in no case have the authors been able to detect any development into more complex forms, and as their observations extended over three years, the number of individuals observed must have been something enormous. These experiments seem to me to be almost conclusive that Abiogenesis is a fallacy arising from the extreme minuteness of the spores of all those simple organisms, and the impossibility of excluding their presence. Messrs. Drysdale

and Dallinger are now experimenting on the effects of heat on the fully developed form, and also on the germs, from which it seems that while the former are destroyed by a moderate heat, the latter can resist a high temperature. The result of these experiments have just been published, and it appears that while the form which gave birth to minute living organisms were scarcely able to survive a temperature of 82-22 e. (nearly 180 Fahrenheit,) the sporules withstood a temperature of 148-88 e. (or nearly 300 Fah.)

The study of these minute and apparently lowly organized forms, appears to me to be highly necessary for the determination of the truth or error of Darwinism; and as far as my very limited researches have gone, the evidence derived from such study is not in favour of the Darwinian hypothesis. There appears as much persistancy of type in the monad above alluded to as in the highest forms of life. We do not find them developing into Rotifers or Tardigrada, any more than we find a sheep developing into a greyhound. I shall perhaps be reminded, that in the latter case I have overlooked one very important element—viz., time, and therefore no change could possibly be discernible during the lifetime of an observer. This objection would, however, hardly apply to the monads, of which something like 180 generations would be produced in the course of one year. Now if a series of observations are extended over three years, 540 generations would have been produced; this would be equivalent to many thousand years of production in the higher orders of mammalia. I might cite many similar examples if time permitted, I must, however, call your attention to those remarkable forms of vegetable life—the Diatomaceæ; they made their first appearance as late as the Mioene epoch, and then they occur in enormous quantities, but we have no trace of any earlier analogous form from which they could have been developed. Recent observations also tend to show that in all probability no form had become extinct or even altered. The keenest observer could not detect a difference between a fossil diatom, provided it was uninjured, and one that was living yesterday. No trace of development into other or more complex organisms has ever been detected, although we have the advantage

of a long period of time, and a large number of forms for comparison, the latter advantage often being denied to the student of the remains of larger forms. If I rightly understand the Darwinian theory, it asserts the probability that all organic forms that have ever existed were produced from one primordial germ, which was endowed with the potentiality of development. If such is the fact, how is it that mental has not proceeded *pari passu* with physical development. The lancelet, which ranks much higher, so far as physical structure is concerned, is far below many insects in mental development; and the beaver, dog, and elephant, are much beyond the monkeys in reasoning power, although the latter rank next to man in structure. I would also remind you of difference of structure exhibited in the bones of different animals, differences so great that it is sometimes possible, by the inspection of a small fragment to tell to what kind of animal it once belonged. Let us also look at the variations in size and outline of the blood corpuscles; will any theory of natural or sexual selection explain why the camel has oval and most other mammals round discs? or that in the musk deer they should not only be smaller than any other species of deer, but also smaller than in any other vertebrate?

In the vegetable kingdom we find the same minute structural distinctions; the starch granules, for example, exhibit such marked differences, that the genus and sometimes the species can be determined by a microscopical examination of a few starch grains.

It is difficult to imagine that any change in external conditions should produce these palpable alterations in microscopic structure. The fact that a human embryo, in its earliest stages, cannot be distinguished from that of a dog, has been brought forward as demonstrative of the oneness of the origin of all organisms, but is it proved that they are alike? although with the means of investigation we at present possess they appear to be so. The microscopist is perfectly well aware that objects, which under the lower powers of the microscope appear identical, are, when more highly magnified, found to be distinct.

Professor Flower, in a paper in "Frazer's Magazine," 1873, says:—"Would any wise master builder, who wished to make

some slight improvement in the structure of his house, pull down the whole fabric and rebuild it from the foundations almost a counterpart of what it was before, and do this not once only nor twice, but again and again times without number. Yet men are not ashamed to attribute to the supremacy of divine wisdom a course of conduct which in their own fellows they would recognize as extravagantly foolish." This comparison appears to me to be very weak: in the first place, if by improvement is meant an altered form, I think we shall find that the alterations are by no means slight; we see not only structural differences, in bone, hair, blood, corpuscles, &c., but differences in the periods of gestation, even in what might be considered allied forms. Secondly—the great Master Builder does pull down and rebuild, not only structures which differ but slightly, but also those which are practically alike. What is death and decay but a pulling down of the living structure? I am quite prepared to admit that a human builder would be considered mad, if in order to effect trifling alterations he were not only to utterly destroy the original building, but even to break up the building materials into their original elements. There exists one grand distinction between the Divine and the human architect; the former destroys or builds up by an effort of Divine will, the other can only do so with infinite trouble and expense.

Professor Flower, a few pages further on, remarks:—"As the extinction of species is still going on, and yet the world seems to present as great a variety as ever, the introduction of species is admitted as possible and probable; and if the introduction must take place by original creation, it has been well put by a distinguished man of science that any morning you might find an elephant standing on your lawn just created." I think if we examine this passage we shall find more fun than argument in it. The few forms that we know have become extinct, have not been replaced by previously unknown species, and when new species are discovered there is no evidence that they did not live at as remote a period as any of the longest known living forms.

The transformation that insects and the lower forms of life undergo, is an argument frequently used in favour of evolution; and

it is certainly somewhat startling to find that a maggot, or caterpillar develops into a form from which it differs in almost every respect. Take the common maggot for example, and compare it with the perfect form, and we find a legless, wingless object, with scarcely any traces of organs of any kind, becoming by some process which eludes the most acute observer, a highly organized creature, with wings, legs, and internal organs highly developed; a delicate respiratory and nervous system, and a tongue or proboscis remarkable for its complicated structure.

The change which takes place here appears to be far greater than would be necessary to develop an anthropoid ape into a man. We do not, however, find that this change is progressive. The fly does not produce any form superior to itself, but only a maggot.

Our supposed remote ancestor the Ascidian larva becomes more imperfect when it assumes the perfect form; it is only during its larva state that it bears any resemblance to a vertebrate.

It is somewhat remarkable that the naturalist has no difficulty in placing in their proper orders those forms which might be supposed to be transitional, such as the whales, dugongs, bats, &c., or even the platypus. It is therefore evident that we must not look upon the whales as a link between beasts and fishes, or the bat as connecting animals with birds.

The believers in special creation do not suppose any new forms have been created since man made his appearance, but they do believe that special creations of forms took place when certain changes occurred on the earth; and although some forms survived through various geological epochs, yet the species peculiar to each period died out, and were replaced by those more adapted to the altered conditions that had taken place, and that this was done by the power and wisdom of an omnipotent Creator.

I feel I ought to apologise for the tediousness of these crude remarks, particularly as they are opposed to modern ideas of the origin of species. I know I am guilty of great presumption in demurring to a system bearing the great and honoured name of Darwin, who, with the humility of a true philosopher, says in every case, "may it not be so." It is left for his followers to dogmatise,

and they who least understand him dogmatise the most. Darwin himself has admitted the probability of the creation of some few typical forms from which all others have been ultimately developed, these type forms must, therefore, have been special creations.

I had intended to have made some special remarks on the advantages and pleasures to be derived from the study of natural history, and also as to the use that this and like societies might be in teaching such knowledge. I cannot but feel that we are in some measure to blame that the fine collections in this building are not of greater interest to the public than they are; to the great majority of visitors they afford but little pleasure or instruction; they see a handsome shell or a beautiful bird, to which is attached a ticket bearing a long name in an unknown tongue; but of the inhabitant of the one, or the physical structure and habits of the other they are quite ignorant.

A love of Nature and the study of natural objects would compete, and not unsuccessfully, with debasing or immoral amusements, and thus in effect the flowers and the birds would become great moral teachers. Ruskin makes the following eloquent remark, which seems specially applicable to this subject:—"They tell us often to meditate in the closet, but they do not send us into the fields at even; they dwell on the duty of self-denial, but they exhibit not the duty of delight. It is not possible for a Christian man to walk across so much as a rood of the natural earth, with a mind unagitated and rightly poised without receiving strength and hope from some stone, leaf, flower, or sound, nor without a sense of the dew falling upon him out of the sky."

"With tender ministrations thou, O Nature,
 Healest thy wandering and distracted child;
 Then pourest on him thy soft influences,
 Thy sunny hues, fair forms, and breathing sweets;
 The melody of woods and winds and waters!
 Till he relent, and can no more endure
 To be a jarring and dissonant thing
 Amidst the general voice and minstrelsy;
 And bursting into tears wins back his way—
 His angry spirit healed and harmonized
 By the benignant touch of love and mercy." (*Coleridge.*)

I.

FAUNA AND FLORA OF NORFOLK.

PART IV. FISHES.

BY JOHN LOWE, M.D.

Read 29th April, 1873.

DISTRICTS which present very diverse physical conditions are generally found to possess a corresponding diversity in their Fauna and Flora, and the county of Norfolk forms no exception to this rule. Possessing as it does a great variety of soil, it is exceptionally rich in the number and rarity of forms of animal and plant life. Nor is it less so in the class under consideration. Of the total number of fishes recorded as occurring in Great Britain, very nearly one half are contained in the accompanying list, and of these many are of great rarity.

The coast line extending from Yarmouth, or rather from Pakefield (for the natural boundary of the county would fairly include that part of Suffolk known under the name of "Lothingland,") to the mouth of the Nene, comprises some of the most productive fisheries in the kingdom. The bays and shallow waters of the coast, and especially of the Norfolk Estuary, form extensive breeding grounds for a great variety of fish, the young fry of which find an abundance of food in the smaller crustacea and entomostraca which exist in immense profusion.

The rivers of the more elevated parts of the county abound in trout, while the extensive "broads," and the sluggish streams of the fen and marshland districts teem with pike, carp, bream, perch, tench, &c., and afford excellent sport to the angler, as well as a lucrative occupation to numbers of men who depend upon this kind of fishing for their maintenance.

It is a subject of much regret that there are not better provisions made by law for the preservation of the young fish on our coasts. Many hundreds of tons of small fry are annually taken in the Estuary, and sold for manure; of these a very large proportion

are young herring, from two to three inches in length. Ten or twelve years ago a considerable amount of full-sized herrings were caught in Lynn waters. At the present time scarcely any are to be had, and the young fry are also much less abundant of late years. The practice of setting 'stow' nets in the river is also gradually destroying the smelt fishery, the fry being caught in large numbers when only an inch in length, and used as bait for eels.

The following enactments, which were formerly in operation in Lynn waters, might with great advantage be revived in the present day, when our fishermen are complaining of the unremunerative nature of their occupation, heedless of the fact that it is due to their own wrong doing.

In the reign of Elizabeth, the following were the "Special orders to be observed by the Fishermen of the Town of Lynn, as well for their orderly fishing in and upon the said River," (Ouse,) "as also for the preservation of the young fry observed there," &c., &c.

First, for orderly fishing.

It is ordained, &c., *inter alia*.

"That no man or his servant shall set any trimmer between German's Bridge and the Cross Beacon, from Holy Thursday to the first of August, but only at the shores, upon pain of forfeiting 3s. 4d.

"That no man shall occupy any swinge of a net, but that threepence may go through, from May-day to the 15th of August, upon pain of forfeiting 3s. 4d.

"That no man or his servant, that go to sea, but as soon as he hath hooked his net, shall throw the brood or fry in again, &c., &c.

"That no man shall bring any prock into the flect, except it be sticklings, on the forfeiture of 3s. 4d.

"If any man shall go a lading, and be found with any brood or prock, both shall forfeit every time, 8s."

Secondly. For the preservation of the spawn and fry of fish.

It is ordained, &c.

"The aforesaid persons, being fishermen, shall also enquire of all offencoes committed against any of these laws, and thereof make true certificate in manner as before specified ;

and among the rest, whether any persons whatsoever do take in this haven or river, within the aforesaid liberties of this town, either with net or any other engine, any young salmons, from the middle of April to St. John Baptist, under the penalty of the statute in that case made and provided."

"Item. To enquire whether any weares be erected within the liberties aforesaid, &c.

"Item. To enquire whether any do hang across the said haven any nets or engines called truncks, or any other sort of nets or engines fastened or hanged continually day and night; whoever shall offend herein shall incur the penalty of the statute made the 2nd of Henry 6th.

"Item. To enquire whether any persons, with any nets, devices, or engines, do take and kill any young brood, spawn, or fry of fish, &c.

"Item. To enquire whether any person that fishes in the said haven for fish, make use of any manner of nets, trammel, keeps, heule, crele, or by any other engine, device, way or means whatsoever, but only with net or trammel, whereof every meshe or mask shall be two inches and a half broad. Provided, nevertheless, that for the taking and killing of smelts, lochies, minims, bull-heads, gudgeons, and eels, it shall be lawful to use such nets, &c., but not to take and kill spawn or fry of fish, under the penalty of the statute."

Mackerell's History of Lynn, pp. 263-4.

The authorities of Lynn are at the present time taking this subject under their serious consideration, with a view to obtaining an act for the better regulation of the fishery.

The primary objects of such an act should be the abolition of river fishery during the spawning period, and a proper supervision of the nets in use. For the smelt fishery it would be necessary to provide stringent enactments, which would protect the spawning grounds in the upper rivers where the greatest damage is inflicted; next, to protect the young fry which are taken in the "stow" nets when on their way to the sea. It would be useless to regulate the size of the meshes in these nets, as the force of the stream draws them so closely together that nothing can pass through.

They ought to be entirely abolished. For the protection of the young fish in shallow water there ought to be a close season, as well as an efficient inspection of nets. It would be of no service to compel the fishermen to throw overboard the small fish, as they are always killed in the trawl-nets, and it is doubtful if very much injury is done to the fishery by these nets, beyond the disturbance of the spawn. The greatest amount of damage is effected by the sprat fishers, and this would be obviated by having a close season, and by a fine inflicted on all who had undersized fish in their boats.

The observations on which the following list is based were made during the few leisure hours which, from time to time, could be obtained in the midst of arduous professional duties; and but for the kind and ready help received from numerous friends, I could not have hoped to make it by any means complete. To J. H. Gurney, Esq., I would take this opportunity of expressing my obligations for a very full list of both marine and fresh water fishes, together with copious and careful notes of their habits and peculiarities. To Mr. Southwell my best thanks are due for a great variety of information, and for much valuable help. The Rev. W. E. Dowell and R. Elwes, Esq. have kindly furnished me with lists of fishes, and to them, as well as to Messrs. H. M. Upeher, F. J. Cresswell, Hele, (Aldborough,) Mills, (Surlingham,) Norman, (Yarmouth,) E. L. King, and T. E. Gunn, I would express my gratitude.

The excellent work on the Natural History of Yarmouth, by Messrs. Paget, has afforded a large amount of valuable material, which I have used freely.

Sir Thos. Browne's list, written in 1662, was the first account of the Norfolk fishes, and contains many interesting observations, which have been incorporated in the present list.

The "L'Estrange Household Book" (1519 to 1578) has furnished some notes which, though not of scientific value, lend a certain amount of interest from their antiquity.

Lubbock's "Fauna of Norfolk" has also afforded me additional information.

The arrangement followed is that of Dr. Günther's Catalogue of Fishes. The abbreviations made use of are, J. H. G.—J. H. Gurney, Esq. P.—Paget's History of Yarmouth.

A LIST OF THE FISHES KNOWN TO OCCUR IN
THE NORFOLK WATERS.

SUB-CLASS I.—TELEOSTEI.

ORDER I.—ACANTHOPTERYGII. FAM. I.—GASTEROSTEIDÆ.

GASTEROSTEUS ACULEATUS (L.) Three-spined Stickleback.

In the Ouse immense quantities of this species are often caught and sold for manure, or used as bait for eel. Mr. Gurney states that in the salt marshes at Cley and Salthouse, where they are very numerous, they appear to form the chief food of the little tern during the nesting season.

GASTEROSTEUS PUNGITIUS (L.) Ten-spined Stickleback.

In ditches near Lynn; not very common.

GASTEROSTEUS SPINACHIA (L.) Fifteen-spined Stickleback.

Yarmouth; "rather rare."—P. Mr. Gurney saw one which was taken from the stomach of a cod-fish purchased in Norwich market.

FAM. III.—PERCIDÆ.

PERCA FLUVIATILIS (L.) Perch.

Mr. Gurney has observed that "in the Yare and Bure they are much larger near the mouths of the rivers where the water is brackish, than higher up where this is not the case."

A perch taken in Ormesby Broad, Sept. 4th, 1866, was recorded by T. E. Gunn, in the "Zoologist," as weighing $4\frac{1}{2}$ lbs., and measuring 18 inches in length.

LABRAX LUPUS (Cuv.) Bass.

Caught occasionally in the Norfolk Estuary; one which I saw in 1865, taken by Mr. Cresswell, weighed 10 lbs.

"Very rarely off Breydon."—P.

Sir T. Browne in his list mentions "the basse, much resembling a flatter kind of cod."

A specimen in the Norwich Museum was presented by Mr. J. H. Gurney.

Often caught in Blakeney harbour on hand lines baited with *Ammodytes lancea*; it varies from 4 to 6 or 7 lbs. in weight."—Rev. E. W. Dowell.

ACERINA CERNUA (Günth.) Ruff or Pope.

In the Ouse above Denver.

Mr. Lubbock speaks of it as being found "in large shoals in the Norfolk rivers." Paget mentions it "in the rivers and broads." Mr. Gurney has met with it in the Yare and Wensum. With the former of these rivers there is considerable historical interest in connection with this fish. "Cuvier assigns the credit of its first discovery to an Englishman whose name was Caius (Dr.) He found it in the river Yare and called it *Aspredo*, a translation of our name ruffe (rough.) Caius sent the first figure of this fish to Gesner, who published it."—*Yarrell*, vol. i, 17, British Fishes.

"*Aspredo fluvialis* pisces est, toto corpore asper, pinnis spinosis, percae formâ et magnitudine. * * * * * Locis gaudet arenosis: et cum alibi in Britannia tum precipue in Hiero flumine (quod nostrum Nordovicum alluens, in Baradenum estuarium ad Hieri ostium (Hiermonth, Yarmonth) oppidum tum piscatum, tum portu celebre, illabitur) frequens est, Nostri Ruffium vocant: quod cum Latinis asperum significat, *Aspredinem* piscem nominavimus."—*Caius, De Rariorum Animalium, &c.* 1570.

Spenser, in his "Marriage of the Thames and Medway," writes:—

"Next cometh Yar, soft washing Norwich walls,
And with him bringeth to their festival
Fish, whose like none else can show
The which men *Ruffins* call."

And Sir Thomas Browne speaks of "the *Aspredo perca minor*, and probably *cernua* of Cardan (?) commonly called a *ruff*; in great plenty in Norwich, and even in the stream of that city; which though Camden appropriates unto this city, yet they are also found in the rivers of Oxford and Cambridge."

FAM. VI.—MULLIDÆ.

MULLUS SURMULETUS (L.) Surmullet.

In the History of Yarmouth it is stated that "10,000 were sent in one week, in May, 1831, to the London market." Though the

species there mentioned is *M. barbatus*, it is evident these were the surmullet—the *red mullet* occurring but rarely. There is indeed no satisfactory record of its having been taken on the Norfolk coast.

Sir T. Browne, in a letter to Dr. Merritt, A.D. 1668, remarks, “we have also a *mullus barbatus ruber*, mineaceus or cinnabarinus, somewhat rough and but dry meat. There is of them major and minor, resembling the figures in Johnstone’s tab. xviii.”

Mr. Gurney writes to me “the red mullet caught on the Eastern coast (usually with mackarel) average much smaller in size than those on the Southern coast, and seldom show any stripes at all conspicuously. I much suspect that many of them, if examined accurately, would be found to belong to the plain red mullet. The large red mullet, with yellow stripes, I never recollect to have seen taken further east than Worthing in Sussex.”

FAM. VII.—SPARIDÆ.

CANTHARUS LINEATUS (White.) Black-sea Bream.

There is a fine specimen of this fish in the Lynn Museum, which was taken in the Norfolk Estuary.

PAGELLUS OWENII. (Günth.) Spanish Bream.

A specimen taken off Sherringham was presented to the Norwich Museum by the Rev. A. Upcher, Nov. 13th, 1846. Mr. Gurney being a little doubtful of the correct naming of this rare fish, through the kindness of the Museum Committee I was allowed to have it for examination. There is no doubt that it is accurately named, and that it has characters quite distinct both from the *Erythrinus* and the common sea bream.

The fin rays are—D. 23 ; V. 5 ; A. 12. The sixth dorsal ray shorter than the one which precedes and the one which follows it.

PAGELLUS CENTRODONTUS (Cuv. and Val.) Sea Bream.

Sherringham, H. M. Upcher, Esq. One taken June 9th, 1868 ; a second, June 12th, 1869.

CHRYSOPHRYS AURATA. (Cuv. and Val.) Gilthead.

Yarmouth, Paget ; taken once or twice. Pakefield, April, 1829, by R. Leathes ; Yarmouth, November 24th, by H. Taylor. These are in the Norwich Museum.

FAM. X.—TRIGLIDÆ.

COTTUS GOBIO (L.) River Bull-head—Miller's Thumb.

Upper Yare, Tudd, and Wensum.

Mr. Gurney sends me the following note:—"A water rail was picked up near the Yare, and a little grebe in the Wensum, both choked in endeavouring to swallow fish of this species."

COTTUS SCORPUS. (L.) Father Lasher.

Very common.

COTTUS BUBALIS (Euphr.)

Cromer, "one specimen."—J. H. G. Norfolk Estuary. It is also mentioned in Sir Thomas Browne's List.

TRIGLA CUCULUS (Bl.) Elleck. Red Gurnard.

Norfolk Estuary, 1865, Mr. E. L. King.

Mr. Elwes has sent me a water-colour sketch of one which he caught in the Estuary. Yarmouth.—P. Sir Thomas Browne, referring probably to this species, mentions the *Gornart cuculus* as a Norfolk species.

TRIGLA HIRUNDO (Bl.) Tubfish.

Norfolk Estuary.—Mr. E. L. King. Mr. Cresswell took a second in 1864.

TRIGLA GURNARDUS (L.) Grey Gurnard.

I have seen several which were taken in the Estuary.

Yarmouth.—P. "Sometimes tolerably abundant on the Norfolk Coast."—J. H. G.

TRIGLA PÆCIOPTERA (C. and V.) Little Gurnard.

The first specimen of this fish caught in British waters, was taken at Youghal, by Mr. William Thompson, of Belfast, in 1837. It has since been met with at Weymouth and Falmouth.

On 15th May, 1873, while trawling in the Lynn roads with Mr. Elwes, I obtained a single specimen of this rare species, of which the following are the measurements:—Length $2\frac{3}{4}$ inches; A. 18, D. 8 (1st shortest, 3rd longest,) 15; P. 10; 3rd separate and free; first dorsal and pectoral fins dark, bluish-black; general colour red; lateral line to dorsal fin, rough with uni-spinous scales.

The only point in which they differ from Thompson's description is in the number of rays in the first dorsal.

AGONUS CATAPHRACTUS (L.) Pogge.

Norfolk Estuary. Common.

Lowestoft.—J. H. G.

Sir T. Browne evidently describes this species:—"A little corticated fish, about three or four inches long, answering that which is named *piscis octangularis* by Schoneveldus—'Octagonius versus caput; versus caudam hexagonius.'"

TRACHINUS DRACO (L.) Greater Weever.

Norfolk Estuary.—R. E. Yarmonth.—P. "Occasionally on the East Norfolk coast."—J. H. G.

TRACHINUS VIPERA (Cuv. and Val.) Common. Weever.

In Sir T. Browne's list this species, rather than the preceding, is referred to, "a sting fish, wiver, or kind of ophthidion, about *four inches long*, with a sharp, small prickly fin along the back, which often venomously pricketh the hands of fishermen."

The erroneous idea that a wound thus inflicted is 'poisoned,' still obtains amongst fishermen, who have a lively aversion to these fish, and kill them with evident pleasure. They also imagine that the fish is capable of striking a blow with scientific accuracy; an idea supported by Mr. Conch, who speaks of "the precision and skill" as "truly surprising." Of the pickled dog fish he makes a similar remark. If this were so it would be indeed surprising, and would be evidence of a high order of intelligence. I have watched them carefully, and could observe only that they make sudden bounds with their fins extended, as do many other species, and notably the percidæ and the eotti, which will also inflict a severe wound if not carefully handled. Of the weevers, it may be remarked that owing to their habit of lying half buried in sand the direction of their spring is upwards.

FAM. XII.—SCLENIDÆ.

SCLENA AQUILA (Risso.) Maigre.

"A specimen taken off Sherringham, in 1841, is in the Norwich Museum."—J. H. G. Another, "rather over five feet long, and

weighing 84 lbs., came ashore at Thorpe, near Aldborough, 30th August, 1868."—*Vide Heles' Aldborough*, p. 182.

FAM. XVI.—SCOMBERIDÆ.

SCOMBER SCOMBER (L.) Mackarel.

Yarmouth, "abundant."—P. "Sometimes they are of a very large size; and one taken this year, 1668, which was by measure an ell long, and of the length of a good salmon, at Lowestoft."—*Sir Thomas Browne*.

Couch says the largest he ever saw measured half an inch over two feet.

SCOMBER THYNNUS (L.) Tunny.

Mr. Gurney writes:—"An immature specimen taken off the Suffolk coast, near Southwold, I believe, is preserved in the Norwich Museum."

T. E. Gunn mentions one taken at Yarmouth, Oct. 6th, 1870, 6 ft. 9 in. in length, 4 ft. 4 in. in girth, weight 224 lbs.

"Small specimens not unfrequently taken during the mackarel fishery."—*Paget*.

AUXIS ROCHEI (Günth.) Plain Bonito.

Two which were taken in June, 1839, off Yarmouth, came into Mr. Yarrell's possession: *British Fishes*, vol. i. p. 160.

A third, also taken off Yarmouth, July 1847, is now in the Museum of the Cambridge Philosophical Society.—T. E. Gunn.

NAUCRATES DUCTOR (L.) Pilot Fish.

"Many years since I saw a specimen freshly caught on the *Suffolk coast*, and sent for preservation to the late Mr. J. Tims, of Norwich, in whose house it was unfortunately destroyed by a fire on the premises."—J. H. G.

ZEUS FABER (L.) Dorec.

"Hitherto considered rare, but this summer (1834,) several have been caught on the Knowl by the turbot fishers."—*Paget*. "Occasionally but not frequently sent from Yarmouth to the Norwich market."—J. H. G.

"The *Faber maximus*, sometimes found very large . . . we often meet with in these seas, sometimes called a peter-fish."—*Sir T. Browne*.

It is sometimes taken in the Wash.

BRAMA RAIL. (Bl.) Ray's Bream.

Mr. Gurney mentions a specimen which was taken at Yarmouth, and is now preserved in the Norwich Museum, and the Rev. E. W. Dowell saw one in Norwich, Jan. 25th, 1847, which was also caught at Yarmouth.

LAMPRIIS LUNA (Gm.) Opah.

"A magnificent specimen found on the breakers (Yarmouth) Nov. 1828 ; another Dec. 24th, 1823."—*Paget*.

Couch mentions another which was caught on the Norfolk coast in 1839 (British Fishes, vol. ii, p. 134.) This is most probably the same which is now in the Wisbeach Museum.

Mr. Foster, the curator, informs me that it was captured off Hunstanton, July, 1839, in the presence of Messrs. Fraser and Jecks. It is also mentioned by Yarrell (vol. i, p. 195.)

"A specimen obtained at Eccles, July 6th, 1844, is in the Norwich Museum."—J. H. G.

FAM. XVII.—CARANGIDÆ.

TRACHURUS TRACHURUS (L.) Scad. Horse Mackerel.

One which I saw taken in the Norfolk Estuary weighed 2 lbs. *Paget* says that at Yarmouth "it is rarely caught and those that are taken are generally small."

"Frequent off Lowestoft."—J. H. G.

"Before the herrings," says *Sir T. Browne*, "there commonly cometh a fish about a foot long, by fishermen called a *horse*, resembling in all points the *Trachurus* of *Rondeletius*."

Mr. H. M. Upcher tells me that he has seen large numbers of the scad in chase of small fry along the coast at Sherringham, and so intent in the pursuit as to be easily taken with a landing net. The beach was quite covered with small fish which were stranded on the shingle after leaping from the water to escape their pursuers.

FAM. XVIII.—XIPHIIDÆ.

XIPHIAS GLADIUS (L.) Swordfish.

Mundesley—H. M. Upeher, Esq.

In August, 1865, a specimen measuring from tip to tip 10 ft. 2 in., was brought to me by some Lynn fishermen, who had found it stranded about four miles below Lynn. There was no wound to account for its death, and it had evidently been left by the receding tide. My friend Dr. T. S. Cobbold, who examined it with me, discovered in it several species of Entozoa new to science. In the stomach there were besides some small fish, the remains of crabs and starfishes. Sir T. Browne mentions one with a sword a yard and a half long, taken by being entangled with herring nets at Yarmouth.

“On the 31st Oct., 1861, a specimen 9 ft. 5 in., including the sword, which measured 3 feet, was observed in shallow water at Mundesley, and captured by a noose being passed over its tail—The head is in the Norwich Museum. I tasted the flesh, and found it very palatable.”—J. H. G.

The sword of one found in the Wash is now in the Wisbeach Museum.

FAM. XIX.—GOBIIDÆ.

GOBIUS UNIPUNCTATUS (Yar.) One-spotted Goby.

Norfolk Estuary. Very common. Yarmouth.—P.

GOBIUS AURATUS (Risso.) Yellow Goby.

Norfolk Estuary. Cromer. Common.—J. H. G.

GOBIUS RHODOPTERUS (Günther.) Speckled Goby.

Norfolk Estuary : July 1868.

GOBIUS MINUTUS (Gm.)

Norfolk Estuary.

GOBIUS PUSILLUS (J. L.)

This, which has not hitherto been described, and is, I think, a well marked species, was first found by me near Lynn about four years ago. D. 6—10, A. 10, V. 10.

Length, $1\frac{1}{2}$ inches ; head rather higher than broad ; dorsal fins

closely approximate—as high as body. Body transparent, covered with dark spots, which are larger and square-shaped along lateral line; anal and second dorsal fins equal and opposite; third ray of first dorsal longest; all the fins transparent, without dots; end of tail square.

In many respects this agrees with *Gobius minutus*, but there are very marked differences, sufficient to establish its specific character.

When transferred to the aquarium from the pool in which they were discovered, these fish lived for a long time in quite fresh water, if gradually accustomed to it, but when suddenly placed in cold fresh water they were apparently asphyxiated, all the fins becoming rigidly expanded. They took food readily from the hand, and would attach themselves to the sides of the glass in any position by means of the ventral fin.

CALLIONYMUS LYRA (L.) Gemmeous Dragonet. Yellow Skulpin.

Norfolk Estuary: common.

Yarmouth: "very rare."—P.

The *dusky skulpin* is now proved to be the female or immature male of this species. In the Estuary the adult male is comparatively rare.

FAM. XX.—DISCOBOLI.

CYCLOPTERUS LUMPUS (L.) Lump fish.

I have seen five or six large ones taken in the Norfolk Estuary within the last ten years.

Paget mentions "one taken in the river" at Yarmouth, in 1819.

"One in the Norwich Museum, taken off Yarmouth, January, 1848, weighed $13\frac{1}{2}$ lbs."—J. H. G.

Sir T. Browne says this fish is "esteemed by some a festival fish, though it affordeth but a glutinous jelly, and the skin is beset with stony knobs after no certain order."

LIPARIS VULGARIS (Cuv.) Sea Snail.

Norfolk Estuary: not common. Cromer.—J. H. G.

LIPARIS MONTAGUI (Cuv.) Montague's Sucker.

I have frequently taken this, which is much more common here

than the preceding, in the Estuary, and several times in the river opposite Lynn, in fresh water at low tide.

Colonel Montague, after whom this species is named, says it "inhabits only the rocky parts of the coast, and of course is rarely taken with the dredge."—*Yarrell*, vol. ii, p. 375.

FAM. XXII.—PEDICULATI.

LOPHIUS PISCATORIUS (L.) Angler.

Norfolk Estuary: not uncommon; sometimes of large size.

Yarmouth.—P. "The *rana piscatrix*, or frog fish, is sometimes found in large magnitude."—*Sir T. Browne*.

FAM. XXIV.—BLENNIIDÆ.

ANARRHICHAS LUPUS (L.) Wolf Fish.

Yarmouth.—P.

Mr. Gurney writes: "I have seen a few taken off the East Norfolk coast, one is in the Norwich Museum."

Sir T. Browne makes mention of the "sea wolf or *lupus nostras* of Schoneveldus, remarkable for its spotted skin and notable teeth."

One in the Wisbeach Museum was taken in the Norfolk Estuary.

BLENNIUS PHOLIS (L.) Shanny.

Cromer: "among stones at low tide."—J. H. G.

CENTRONOTUS GUNNELLUS (Bl. Schn.) Butterfish.

Norfolk Estuary: common.

Yarmouth.—P. Cromer.—J. H. G.

ZOARCES VIVIPARUS (L.) Viviparous Blenny.

Norfolk Estuary. Yarmouth.—P.

Mr. Gurney says:—"Adult specimens are found near the beach, Lowestoft, and in the later summer months young ones, about an inch in length, are abundant in the upper part of the inner harbour at Lowestoft, where they frequent the mud banks, and I think burrow in them."

FAM. XXXVII.—ATHERINIDÆ.

ATHERINA PRESBYTER (Cuv.) Atherine.

Lowestoft.—J. H. G.

Norfolk Estuary—frequent in the summer months.

FAM. XXXVIII.—MUGILIDÆ.

MUGIL CAPITO (Cuv.) Grey Mullet.

Norfolk Estuary: common. Yarmouth.—P.

“Several years ago,” Mr. Gurney writes, “a lot of unusually large grey mullet, were sent to the Norwich market from Blakeney. I have also seen some very fine specimens taken on the Suffolk coast, at the mouth of the river Orwell.”

MUGIL CHELO (Cuv.) Lesser Grey Mullet.

Norfolk Estuary.—F. J. Cresswell, Esq.

FAM. XLII.—GOBIESOCIDÆ.

LEPADOGASTER BIMACULATUS (Günth.) Two-spotted Sucker.

For the only record of this being taken on the Norfolk coast I am indebted to the Rev. E. W. Dowell, who caught one at Blakeney, in July, 1846.

ORDER II.—ACANTHOPTERYGII PHARYNGOGNATHI.

FAM. II.—LABRIDÆ.

LABRUS MACULATUS (Bloch.) Ballan Wrasse.

“A young one, about eight inches long, was taken with hook and line in the outer harbour at *Lowestoft*, in August, 1852,”—J. H. G.

Yarmouth, April 15th, 1868.—Gunn. Lynn Roads, Nov. 14th, 1869.—E. L. King.

LABRUS MIXTUS (L.) Green Wrasse.

A specimen in the Wisbeach Museum was, as I am informed by Mr. Foster, the curator, captured in the Norfolk Estuary in 1850. Mr. Cresswell has once taken this fish off Hunstanton.

ORDER III.—ANACANTHINI. FAM. III.—GADIDÆ.

GADUS MORRHUA (L.) Cod.

Mr. Gurney has the following notes :—“It used to be thought that the finest eod supplied to the Norwich fish-market were those sent up from Sherringham, which were usually found to have been feeding on erabs.” “On 16th May, 1851, I saw a fish caught at Lowestoft, and called there by the fishermen a “lord,” resembling the variety often eod figured under that name by Yarrell in his second edition, vol. ii, p. 229. This specimen was $15\frac{1}{2}$ in. long, and its fin rays numbered as under :—

Dorsal, 11, 15, and 16 ; pectoral, 19 ; ventral, 7 ; anal, 17 and 16 ; caudal, 34.

GADUS EGLEFINUS (L.) Haddock.

Norfolk Estuary : common.

Yarmouth.—P. In Sir T. Browne's list :—“*Asellus minor Schöneveldi (callarius plinii)*, or haddocks.”

GADUS LUSCUS (L.) Bib.

Lowestoft.—J. H. G. Norfolk Estuary.

GADUS MERLANGUS (L.) Whiting.

Norfolk Estuary : plentiful.

Yarmouth.—P. Plentiful off Lowestoft, especially in autumn.” —J. H. G. “The whiting on the coasts of Norfolk and Suffolk, only attains about two-thirds the size of those on the Devonshire coast.”—Ib. “*Asellus albus*, or whittings, in great plenty.”—*Sir T. Browne*.

GADUS VIRENS (L.) Coal-fish. Green Cod.

Yarmouth : “plentiful.”—P. “*Asellus niger, carbonarius*, or coal-fish.”—*Sir T. Browne*.

A large one caught in the Norfolk Estuary in 1845, is in the Wisbeach Museum.

The Rev. E. W. Dowell has frequently taken them with the line in Blakeney harbour.

LOTA VULGARIS (Yar.) Burbolt.

Yare, Bure, and Waveney. “It penetrates almost to the sources of the rivers. I have known many caught, and some

two or three pounds in weight, from the small streams which unite to form the Thet."—*Lubbock's* "Fauna of Norfolk."

"One in Norwich Museum taken near Shropham."—J. H. G.

Sir Thomas Browne mentions it—"to be had in the Norwich river and between it and Yarmouth, as also in the rivers of Marshland."

Mr. Norman, of Yarmouth, caught one 2 lbs. 2 ozs. in weight, near Berney Arms, Cement Works.

MERLUCIUS VULGARIS (Fleming.) Hake.

"In February, 1847, a hake about 30 inches long, was caught off Sherringham."—J. H. G.

MOLVA VULGARIS (L.) Ling.

Norfolk Estuary: common, but not of large size.

Yarmouth.—P.

In the "L'Estrange Household Book," frequent mention is made of this species—*e. g.*—11 Hen. VIII., 1519:—

"Item.—P^d for half a hundred Lynges xd. Item.—For carrying of y^e same Lynges fr. y^e Bulle to y^e comon Stath, iijjd."

MOTELLA TRICIRRATA (Bl.) Three-bearded Rockling.

Norfolk Estuary.—Mr. Plowright. Sherringham, one specimen.—J. H. G.

MOTELLA MUSTELA (L.) Five-bearded Rockling.

Norfolk Estuary, two—Aug., 1870; Sept., 1871."—Mr. Plowright. Yarmouth.—P. "A very small specimen taken Dec. 17th, 1821." "Abundant at Cromer among stones at low water."—J. H. G.

RANICEPS TRIFURCUS (Walb.) Lesser Forkbeard.

Norfolk Estuary.—Mr. Plowright. "A few taken off Cromer."—J. H. G. Sherringham, Jan. 29th, 1846: Rev. E. W. Dowel ("Zoologist," 1264.) "One of the rarest British species."—*Yarrell*, vol. ii, 293.

FAM. IV.—OPHIDIIDÆ.

AMMODYTES TOBIANUS (L.) Larger sand-launce.

Norfolk Estuary. Common.

Yarmouth.—P. Lowestoft. Common.—J. H. G.

Sir T. Browne observes—"The sand-eels (*Anglonas* of Aldrovandus, or *Tobianus* of Schoneveldus) commonly called *smoulds*, taken out of the sea-sands, with forks and rakes, about Blakeney and Burnham: a small, round, slender fish, about three or four inches long, as big as a small tobacco pipe; a very dainty dish."

AMMODYTES LANCEOLATUS (Lesauv.) Lesser sand-launce.
Norfolk Estuary.

FAM. VII.—PLEURONECTIDÆ.

HIPPOGLOSSUS VULGARIS. (Flem.) Holibut.
Norfolk Estuary.

Yarmouth.—P. "The Norwich Papers of 15th February, 1873, record the exhibition in Norwich fish-market of a holibut taken off Yarmouth. It measured 5 ft. 4 in. long, 2 ft. 6 in. broad, 9 in. thick, and weighed $7\frac{1}{2}$ stones."—J. H. G.

RHOMBUS MAXIMUS (L.) Turbot.

Norfolk Estuary. Yarmouth.—P. "A large turbot, in excellent condition, alive and in full vigour, was brought to me in Lowestoft, having been caught in the deep channel which runs close to the shore opposite the Esplanade; and a respectable fisherman, in whose veracity I place full confidence, told me that he once caught two large turbot at once, at the head of Lowestoft inner harbour, just below Mutford Lock."—J. H. G.

This and the following species are mentioned by Sir T. Browne: "The great rhombus or turbot, *aculeatus et levis*."

In the "L'Estrange Household Book," A.D. 1519.—"Item.—A fresh turbutt, ijs. iiijd."

RHOMBUS LÆVIS (L.) Brill.

Norfolk Estuary. Common. Yarmouth.—P.

"L'Estrange Household Book."—"Item.—Paid to John Syft, for a brattcocke, viijd." Sir T. Browne refers to this in the following distich (MS. Sloan, 1784,) with the explanatory note:—

"Of wry-mouthed fish! give me the left side black,*
Except the sole, † which hath the noblest smack."

* As turbot, *bret*, *bretcock*, skrills. † Which is black on the right side as also butts, sandaps, and flounders.

Mr. Gurney informs me that "from thirty to forty years ago a flat fish was commonly caught about Wells, which was locally called a 'braddock,' but I have not been able to ascertain its scientific name."

The term is still used here with reference to the brill.

PLEURONECTES PLATESSA (L.) Plaice. Common.

"Item.—Paid for x plaices, iij."—"L'Estrange Household Book."

PLEURONECTES LIMANDA (L.) Dab.

PLEURONECTES FLESUS (L.) Flounder.

Norfolk Estuary. Common.

In 1862 an albino variety was brought to me. Both sides were white, and the fins and eyes pink.

Yarmouth.—P. Lowestoft.—J. H. G. "Small flounders occur in the Yare, as high up as the "New Mills" at Norwich, which is the first stoppage in the river to fish ascending from the sea."—J. H. G.

I have frequently seen specimens caught in the Ouse, which were affected with a peculiar skin disease resembling epithelioma—large fungous growths cropping out over the whole body—the granulations large and roe-like—under the microscope consisting of large nucleated cells.

PLEURONECTES MICROCEPHALUS (Donov.) Smear'd dab.

Norfolk Estuary.

SOLEA VULGARIS (Quensel.) Sole.

Norfolk Estuary. Common.

Yarmouth.—P.

Mr. Gurney thinks that "the sole, like the whiting, attains only about two thirds the size on the coasts of Norfolk and Suffolk that it does on the Devonshire coast." Very large specimens are, however, occasionally taken in Lynn Deep.

ORDER IV.—PHYSOSTOMI. FAM. VII.—SALMONIDÆ.

SALMO SALAR (L.) Salmon.

Yarmouth. "Small ones have very rarely been taken in the mackarel nets."—Paget.

Sir T. Browne observes—"Salmon no common fish in our rivers, though many were taken in the Ouse; in the Bure or north river; in the Waveney or south river; in the Norwich river but seldom, and in the winter. But four years ago, fifteen were taken at Trowse Mill at Christmas, whose mouths were stuck with small worms or horse leeches, no bigger than fine threads. * * * Most of our salmon *have a recurved piece of flesh* in the end of the lower jaw, which, when they shut their mouths, deeply enters the upper, as Scaliger hath noted in some."

Of late years the salmon seems to have disappeared from the Norfolk coasts. The only instance of which I have any record, is one which was caught in a flooded meadow at Lakenham, about December 1st, 1873. This was shown by Mr. Gurney to Dr. Günther, who pronounced it beyond doubt a true salmon. It has been presented by Mr. Birkbeck to the Norwich Museum. Mr. Gurney says this is the first Norfolk salmon he has seen.

SALMO TRUTTA (Flem.) Salmon trout.

Frequently caught in the Ouse and the Estuary.

In the Bure and Waveney.--*Lubbock*.

Mr. Stevenson reports that one was taken with rod and line, at Lyng Mills, March, 1862. It weighed 15 lbs., and was 31 inches in length. Another taken at the same place soon afterwards weighed 10 lbs.

Mr. Gurney thinks these could not have been *Salmo trutta*, "as no sea-trout could ascend the river higher than the 'New Mills' at Norwich."

Mr. Dowell observes that the salmon trout remains on our coasts at all times of the year, but he has never seen it with roe.

In the "L'Estrange Household Book."—"Item.--Paid for a samon troute, x*d*."

SALMO FEROX (Jard. and Selb.) Lake trout.

Mr. J. J. Colman, of Norwich, a few years since, hatched a number of the ova of this species, and introduced them into the small streams near Eaton and Cossey. "A few more," he says, in a letter to Mr. Gurney, "went to the Stoke (Holy Cross) river, and some to the stream between Keswick Mills and Lakenham. I gave some to Mr. Cozens Hardy, of Letheringsett, but I believe they were all

eaten by ducks. In the Eaton stream there are scarcely any to be seen, though I have taken only about two fish out—one of them was undoubtedly a Lake trout, weighing 3 or 4 lbs."

SALMO FARIO (L.) Common trout.

Narborough, Castleaere, &c.

Bure and Yare.—*Lubbock*.

Mr. Gurney thinks the supposed "salmon," from Cossey and Swanton, mentioned in Lubbock's "Fauna," were of this species, also the Lyng specimen recorded by Mr. Stevenson; and he adds "it is remarkable that this fish, though abundant in the Wensum, is not a native of the Upper Yare, and an attempt to introduce them artificially by hatching ova in the Yare appears to have failed."

In the Tudd, a small stream intermediate between the Upper Wensum and Upper Yare, trout are found, and grow large, but are said to be descended from some artificially introduced from thirty to forty years ago.

If trout exist in the Yare, as stated by Lubbock, I believe it is only in the lower stream, after it has been joined by the Wensum.

A remarkably fine trout of this species was taken 14th February, 1867, in the river Blyth, near Halesworth. This fish (of which I have seen a photograph) weighed 15 lbs., and measured 40 inches in total length, and was 21 inches in girth.

Sir T. Browne mentions "the *trutta*, or trout, and the *gammarus*, or crawfish, but scarce in our rivers; but frequently taken in the Bure or North river, and in the several branches thereof;" and he adds, "very remarkable large crawfishes to be found in the river which runs by Castleaere and Nerford." Query, are they still to be found in that locality?

OSMERUS EPERLANUS (L.) Smelt.

Very abundant in the shallow waters of the Estuary, and on the Burgh Flats, Yarmouth, where they often attain a large size. Mr. Norman has measured some taken at the latter place, which were eleven inches and a half long, and weighed seven ounces. I have seen fish of exactly the same size and weight (Feb. 21st, 1874) taken on the Ouse. These were full of roe. In 1867 I saw one which was a foot long, and which weighed only a quarter of a pound.

The smelt fishery is much damaged by the practice of taking them in the rivers during the spawning season. Immense quantities are caught in what ought to be the close season, when they are watery and insipid. There ought to be a strict prohibition against taking them whilst in the rivers.

In Sir T. Browne's list mention is made of "spirinehes,"* or smelt in great plenty about Lynn; but where they have also a small fish called a *priame*, answering in taste and shape a smelt; and perhaps are but a younger sort thereof."

"They ascend the Norwich river as far as the 'New Mills,' where great numbers are taken every season."—J. H. G.

Mr. Southwell informs me that many are kept alive in tanks, in the Norwich fish-market until required for use.

FAM. XII.—ESOCIDÆ.

ESOX LUCIUS (L.) Pike.

Attains a large size in the Norfolk Broads, from 25 to 35 lbs.—*Lubbock*.

Mr. R. R. B. Norman mentions (in "Land and Water," 1873,) one taken in the Broads near Yarmouth, which weighed 36½ lbs., and was 54 inches long; it was caught with a trimmer.

FAM. XIV.—SCOMBRESOCIDÆ.

SCOMBRESOX SAURUS (Walb.) Skipper.

Yarmouth.—J. H. G.

"Two specimens, about 16 inches long, caught October 25th, 1844, are now in the Norwich Museum."

Blakeney Harbour, December 7th, 1846.—*Rev. E. W. Dowell*.

Sir T. Browne remarks, "The saurus we sometimes meet with young. Rondeletius confesseth it a very rare fish, somewhat resembling the *acus* or needlefish before, and maekarel behind."

BELONE VULGARIS (Flem.) Garfish.

Lynn Roads.—Mr. E. L. King.

* Mr. Gurney adds the following note:—"In Moule's 'Heraldry of Fis' 'spiering' is given as the Dutch name for the smelt."

Lubbock says this has been taken within five miles of Norwich.

"The *acus major*, called by some garfish and greenback, answering the figure of Rondelctius, under the name of *acus prima species*, remarkable for its quadrangular figure and *verdigrease-green bone*."—*Sir T. Browne*.

In the editor's foot-note this is incorrectly given as *Centriscus scolopax*, a Mediterranean fish, not likely to be caught on the Norfolk coasts.

HEMIRAMPHUS EUROPEUS (Yar.) Europæan half beak.

Ouse below Lynn, July 6th, 1868. I found large numbers of these singular fish skimming along the surface of the water with a wriggling motion. The day was bright, the water singularly smooth, and the surface was continually disturbed by these active little creatures, of which there must have been many thousands, engaged in taking their prey. I captured a considerable number of them, and on examination, found that their food consisted of small *entomostraca*, amongst which, in the stomach of one, were thirty specimens of *Canthocamptus stromii*, which I had hitherto found very rare in these waters, and in one I also found a nematode worm an inch long.

One feature of the halfbeak appears to have escaped previous observation, as it is not mentioned by Couch or Yarrell, and the published figures are equally defective. The lower jaw, which extends far beyond the other, is provided with a broad membrane on each side, giving a total width of one-eighth of an inch, thus aiding materially in taking its prey, as the jaw is converted into a sort of scoop. On being removed from the water, the membrane, which is covered with dark radiating spots, collapses, and the beak has then the acicular character seen in the plates. The membrane does not extend quite to the tip, but the jaw is apiculate.

This fish had only been seen four or five times previously, and I have never found it again, though I have repeatedly searched for it at the same time of year. This is remarkable, as it is obvious, from the configuration of the jaw, that it is only fitted for surface feeding on *entomostraca*, and small insects which are found on the surface of the water in bright, still weather. It ought, therefore, to be frequently met with if it be a mature form, and not, as has been supposed, an early state of some other species.

FAM.—XVII. CYPRINIDÆ.

CYPRINUS CARPIO (L.) Carp.

A large one was taken in the Kettle Mills pond, Lynn, in 1865. Mr. Lubbock says "it is not common upon the whole of the broads, but where it does occur grows to the very largest size; the dimensions of one lately taken are as follows—length, $29\frac{1}{4}$ in., girth, 29 in., weight, $15\frac{1}{2}$ lbs."

"Nearly forty years since a carp, of about 12 lbs. weight, was found alive and healthy in a drain communicating with the River Wensum, near the site of the old Blackfriars Monastery, at Norwich. With this exception I never knew a carp taken in the Norwich river."—J. H. G.

Sir T. Browne says, "two of the largest I ever beheld were taken in the Norwich river."

CYPRINUS AURATUS (L.) Gold-fish.

Mr. Gunn says these fish are "bred at several mill-pools in Norfolk," but gives no locality.

CARASSIAS VULGARIS (NILSS.) Crucian.

"A solitary specimen has been twice observed in the Yare."
—"Fauna of Norfolk."

Mr. Gurney informs me that it is common in ponds in East Norfolk, and he says "it is well known to hybridize freely with the common carp. Some years since some hybrids of this description, bred at Hempstead, near Holt, were identified as such by Dr. Günther, to whom I sent them for examination. At Hempstead the true carp generally attains 8 lbs. in weight, and the hybrid about half that weight. The largest specimen of *Cyprinus Carassias* of which I have note weighed only 1 lb. 7 ozs."

GOBIO FLUVIATILIS (Flem.) Gudgeon.

Lynn.

The broads.—P. "Abundant in the higher part of the rivers, but not, I think, otherwise than of rare occurrence amongst the broads."—*Lubbock*. "The upper part of the Yare, the Tudd, and the upper part of the Wensum."—J. H. G. "Gudgeons or *funduli fluviatilis*; many whereof may be taken in the river within the city."—*Sir T. Browne*.

LEUCISCUS RUTILUS (L.) Roach.

Common in streams and broads.

Mr. Gurney remarks that they are very fine in the Yare and Wensum. Mr. Norman caught one at Yarmouth which weighed 2 lbs. 2 ozs.

LEUCISCUS BUGGENHAGII (Cuv. and Val.) Pomeranian Bream.

Surlingham broad.—Mr. Mills. "One taken at Cossey, upwards of four pounds in weight, is now in the Norwich Museum."—*Lubbock*.

This has been proved by Professor Von Siebold to be a hybrid between *Abramis brama* and *Leuciscus rutilus*.

LEUCISCUS CEPHALUS (L.) Chub.

"Is totally unknown in the Bure, the Yare, and I believe the Waveney. Is very large in some Norfolk rivers, the Ouse, the Thet, and the Wissey, near Stoke Ferry."—*Lubbock*.

Sir T. Browne remarks, "the chubbe,.....to be found in divers other rivers in England, I have not observed in these."

LEUCISCUS ERYTHROPHthalmus (L.) Rudd.

Common in the broads and rivers.

Mr. Norman has taken one weighing 3 lbs. 1 oz.

LEUCISCUS VULGARIS (Cuv.) Dace.

Common.

"Abundant and large in the upper Yare. Does not thrive in ponds."—J. H. G.

This and the two preceding are mentioned in Sir T. Browne's list.

Mr. T. G. Bayfield, of Norwich, states that a specimen of what he confidently believed to be the *var. Leuciscus cæruleus* was taken some years ago by Mr. Ewing, between Keswick and Cringleford Mills.

LEUCISCUS PHOXINUS (L.) Minnow.

TINCA VULGARIS (Yar.) Tench.

Common in lakes and ponds.

Mr. Gurney says "the only river locality I know for the tench in Norfolk is in the Yare, above Trowse." It occurs also in the

Ouse, above Denver. Mr. Norman informs me that the largest he has caught near Yarmouth weighed 5 lbs. 14 ozs.

ABRAMIS BRAMA (L.) Lake Bream.

Ouse and Brandon river, very abundant and attaining a large size.

Yare.—J. H. G.

“I have twice known a bream of 7 lbs. weight taken in the Wensum, at Cossey. One of these specimens was:—length, $25\frac{1}{2}$ in., depth, $8\frac{1}{2}$ in., thickness, $3\frac{1}{2}$ in., weight, 7 lbs. 1 oz. The large bream bear the local name of ‘bellows’ in the neighbourhood of Norwich.”

Mr. Norman, of Yarmouth, tells me he caught a bream which weighed 8 lbs. 12 ozs.

ABRAMIS BLICCA (Bl.) White Bream.

Norfolk Broads.—*Lubbock*.

ALBURNUS LUCIDUS (Heck et Kner.) Bleak.

Very abundant in ditches at North Wootton. I have seen some which were taken in the Ouse, below Denver sluice, at low water. Though probably occurring in other parts of Norfolk these are the only localities of which I have any record of their having been taken.

NEMACHILUS BARBATULUS (L.) Loach.

“Not gregarious or abundant, but found in the smaller streams, wherever stones afford a lurking place.”—*Lubbock*.

FAM. XXI.—CLUPEIDÆ.

ENGRAULIS ENCRASICHOLUS (Cuv.) Anchovy.

Frequently caught during the summer months, in stow nets in the river opposite Lynn. They are generally from seven to eight inches in length.

Yarmouth: “A specimen found on this beach, May, 1830.”—*Paget*. This is probably the same referred to in “Yarrell’s British Fishes,” communicated by Mr. Dawson Turner.

CLUPEA HARENGUS (L.) Herring.

Mr. T. Southwell has kindly sent me the following official

return of the number of herring landed at the Fish-wharf in the Autumn Fishery at Yarmouth and Lowestoft.

Year.	No. of Lasts,* Yarmouth.	Lasts at Lowestoft.
1867	No account.	6,154
1868	15,511	7,035
1869	13,386	6,912
1870	18,769 and 2000 at Quay.	10,456
1871	19,871 and a great quantity landed at Quay.	14,390
1872	14,500	6,920
1873	18,795	10,937

* The number of fish in a last is 13,200.

The herring is frequently mentioned in the "L'Estrange Household Book." "Item.—To John Browne, of Lynn, for ij barrels of whyte herynges, xxijd." "Item.—Paid to Richard Bessye, of Lynn, for ij cases of red heryngs, xvjd."

CLUPEA LEACHII (Yar.) Leach's Herring.

This, which Mr. Yarrell had regarded as a good species, and named after its discoverer Dr. Leach, I had for a long time considered as merely an immature form of the common herring. It is almost the only kind taken in the estuary at the early part of the year. I believe it to be the fish of the previous year, spawning for the first time. The following brief abstract of a paper read before the West Norfolk and Lynn Natural History Society, will show the reasons which I had for discarding it as a species:—

"On the specific characters of Leach's Herring of Yarrell:"
Jan. 1864.

"The occurrence of spawning herrings at the mouths of estuaries in the early months of the year, and a certain dissimilarity betwixt these and the common herring, led Mr. Yarrell to describe them as a new species, under the name of *Clupea Leachii*. The chief

distinctive characters which he notices are the relative lengths of the head and body, and the depth of the fish compared to its length. Yarrell gives the number of vertebræ as 54, whereas in the common or northern herring they are 56. The colour of Leach's herring is brighter, and more decidedly blue. There is also a difference in the scales, which are comparatively larger in Leach's herring.

"As regards the measurements, it is obvious, that if, as I believe, Leach's herring is an immature form, the ratio would alter with increased growth. So also would the colour with the age of the fish, and with the period of fecundation.

"The difference then rests solely on the number of vertebræ. On examining (Jan. 27th, 1864) a number of Leach's herring full of ova, I found that the measurements were somewhat different from those given by Yarrell. The comparative length of head and body were as $1-3\frac{1}{4}-3\frac{1}{2}$ in all cases. Depth to length as $1-5\frac{1}{2}$ or 6, in those which had spawned, $1-4\frac{1}{2}$ in those with roe. Of 9 fish examined with reference to the number of vertebræ 4 had 55. 2 had 54. 3 had 56.

"In some of those which had less than 56 vertebræ I was able to discern one or two which were rudimentary or abortive, thus showing that 56 is really the normal number as in the northern herring.

"The position of the dorsal fin noticed by Yarrell, would also vary with the growth of the fish. Subsequent observations at a later period of the year showed a marked alteration in the comparative measurements, and a nearer approximation to those found in the common herring."

These observations were forwarded, together with specimens, to Mr. Couch, of Polperro.

In reply Mr. Couch says :—

"Polperro, Feb. 13th, 1864.

"It may be a matter of curiosity to you to be informed, that on the 6th of this month I made the following note in my Journal. 'A large herring, male, with milt of full size of development—herrings seem in tolerable abundance—the fact of their having fully enlarged milt and roe is a reply to one of Mr. Yarrell's arguments for Mr. Leach's herring being a separate species, by breeding at that time, but is it a good species?'"

On the 7th of March he writes :—

“Your little box of herrings came safely, and they have been closely examined, having been hardened with salt. My conviction is the same with what appears to be your own as regards Leach’s herring ; my only remaining difficulty having been the difference in the number of vertebræ, and on that point, I hope, I may be at liberty to quote your authority. I had not so far examined as to be certain of a variety in that respect.”

It will be thus seen, that Mr. Couch agrees with me in thinking, that this so-called species can no longer be maintained.

CLUPEA SPRATTUS (L.) Sprat.

Very abundant along the coast.

Sir T. Browne says, “Herrings departed, sprats, or *sardæ*, not long after succeed in great plenty, which are taken with smaller nets, and smoked and dried like herrings, become a sapid bit and vendible abroad.”

On the coasts of Norfolk and Lincolnshire many hundreds of tons of sprats are annually used for manure, a waste of valuable food, much to be regretted. Were a company formed for preserving them after the manner of Sardines, to which they are in no respect inferior, a vast amount of food might be saved, and the undertaking if properly managed might be made very remunerative.

Mr. Dowell says, that though he has seen vast quantities of these fish caught he never yet saw one with roe.

Considerable quantities are prepared and sold as anchovies and anchovy paste.

CLUPEA ALOSA (L.) Allis Shad.

Yarmouth, “not uncommon with herrings.”—P. New Mills, Norwich, (June, 1840,)—*Lubbock*.

“Two specimens, male and female, caught at Lowestoft in May, 1840. Weighed, the male 3½ lbs. ; the female 4¼ lbs. Both are preserved in the Norwich Museum.”—J. H. G.

Sir T. Browne says, “Alosa or Shads, to be met with about Lynn.” Norfolk Estuary, 1851, specimen in Wisbeach Museum.

CLUPEA FINTA (Cuv.) Twait Shad.

Lynn Roads, Sept. 1848, and Oct. 1867.—Mr. E. L. King. Yarmouth, not uncommon.—P. Lowestoft, “a fine specimen

caught with hook and line, June 1867, weighed upwards of 2 lbs."—T. E. Gunn.

CLUPEA PILCHARDUS (Cuv.) Pilchard.

Yarmouth, "Some few generally taken every year in the herring nets; in some years they have been abundant."—P. "Though this sea aboundeth not with pilchards, yet they are commonly taken among herrings; but few esteem thereof or eat them."—*Sir T. Browne*.

FAM. XXVII.—SYMBRANCHIDÆ.

ANGUILLA VULGARIS (Flem.) Sharp-nosed Eel.

Very common. Mr. Lubbock says that one was caught near Norwich which weighed upwards of 20 lbs.

"One taken in the Ouse at Denver Sluice, 22nd October, 1867, and its dimensions recorded in 'Land and Water,' of the 28th of that month, by E. A. Austin, Esq., Sydney Sussex Coll. Camb.; were, length 5 ft. 8 in., girth $17\frac{1}{4}$ in., weight 36 lbs."—"Fauna of Norfolk."

ANGUILLA LATIROSTRIS (Risso.) Broad-nosed Eel.

Common. Mr. Gurney thinks it decidedly less abundant in East Norfolk than the preceding species. He has seen it from the Upper Yare and the Tudd, and has heard of it as inhabiting Saham Mere. On August 16th, 1866, (recorded by Mr. T. E. Gunn, in the *Zoologist*), "One of these eels was netted in the Bure at Horning, which weighed $7\frac{1}{4}$ lbs., was 3 ft. 8 in. long, and 10 in. in girth."

CONGER VULGARIS (Cuv.) Conger.

Norfolk Estuary. Not uncommon. Yarmouth.—P. "One weighing nearly 50 lbs., caught in 1808." Cromer.—J. H. G.

ORDER V.—LOPHOBRANCHII. FAM. II.—SYGNATHIDÆ.

SIPHONOSTOMA TYPHLE (L.) Broad-nosed Pipe-fish.

Norfolk Estuary. One which was taken at Heacham is in the Norwich Museum. Yarmouth.—P. Lowestoft.—J. H. G.

SYGNATHUS ACUS (L.) Greater Pipe-fish.

Common.

NEROPHIS ÆQUOREUS (L.) Ocean Pipe-fish.

Mr. Elwes has taken this in the Norfolk Estuary.

NEROPHIS OPHIDION (L.) Straight-nosed Pipe-fish.

Norfolk Estuary, June 12th, 1871.—Mr. E. L. King.

HIPPOCAMPUS ANTIQUORUM (Leach.) Sea-horse.

Yarmouth. This is given in Messrs. Paget's list, but there is no other record of its having been taken on the Norfolk coast.

ORDER VI.—PLECTOGNATHI. FAM. II.—GYMNODONTES.

ORTHAGORISCUS MOLA (L.) Sun-fish.

Lynn, two, Nov., 1850; Oct. 1863.—Mr. E. L. King. Yarmouth.—P. "One taken Nov. 1821. Salthouse, Nov. 1850."—Rev. E. W. Dowell. "The Norwich Museum contains one taken off Overstrand in 1843."—J. H. G.

Sir T. Browne says: "Sometimes we meet with a *mola*, or moonfish, so called from some resemblance it hath to a crescent in the extreme part of the body, from one fin unto another. One being taken near the shore at Yarmouth, before break of day, seemed to grunt and shiver like a hog, * * * The gills of these fish we found beset with a kind of sea louse.* In the year 1667 a *mola* was taken at Mousley, which weighed 200 lbs."

Mr. Southwell saw one at Lynn, Nov. 15th, 1850. Its dimensions were 4 ft. long, 2 ft. deep, and about 15 in. thick. Another at Thornham Hall, which was 4 ft. 3 in. from nose to tail, 6 feet in depth across the fins, which were each 2 feet in length, weight 210 lbs., is recorded in "The Field," Jan. 7th, 1865. One in the Wisbeach Museum was taken at Yarmouth in 1835.

SUB-CLASS III.—GANOIDEI.

ORDER II.—CHONDROSTEI. FAM. I.—ACIPENSERIDÆ.

ACIPENSER STURIO (L.) Sturgeon.

Frequently caught in the rivers and along the coast, and chiefly, as Mr. Southwell has remarked, in the winter and spring months.

* *Lepeoptheirus Nordmannii*.

Sir Thomas Browne, with his usual accuracy, notes the variation in form which occurs in this species :—" Some have been taken at Yarmouth, and more in the Great Ouse, but their heads are not so sharp as represented in the icons of Rondeletius and Johnstonus."

Couch, speaking of the supposed two kinds of sturgeon, says :—" The broad-headed and narrow-snouted varieties in their extreme divergence differ greatly, and the latter appears to be the more numerous of the two ; but there has been found every gradation of form among them."—Vol. i, p. 159.

The Lord of the manor of Hunstanton claims as a royalty all sturgeons caught in Lynn waters, but this claim is not recognized by the Lynn authorities. The largest specimens of which I have any note are—one caught off Yarmouth, Oct. 10th, 1871, of which Mr. Southwell gives the following measurements. Length, 7 ft. 10 in. ; girth, 46 inches ; weight, 392 lbs. ; and one recorded by Mr. Gunn, in the " Zoologist," 1866, taken in Holkham Bay, was 8 ft. 6 in. long, and weighed 210 lbs. Another taken off the Suffolk coast, was 12 ft. 2 in. long, and weighed only 156 lbs.

SUB-CLASS IV.—CHONDROPTERYGII.

ORDER II.—PLAGIOSTOMATA. FAM. I.—CHARCHARIIDÆ.

CARCHARIUS GLAUCUS (Cuv.) Blue Shark.

Yarmouth.—P.

I have no authentic record of this fish being taken in the Estuary, and suspect that the toper is sometimes mistaken for it. Thus, two specimens in the Wisbeach Museum, said to be blue sharks are in reality topers. Mr. T. E. Gunn records one specimen stranded on the beach at Yarmouth, Dec. 19th, 1866, and gives the following measurements :—Total length 5 ft. 4 in. ; length of head, $10\frac{3}{4}$ in. ; girth to first dorsal, 1 ft. 7 in. These might, in the absence of other characters, apply equally to the tope.

Mr. Hele, of Aldeburgh, Suffolk, records the capture of one at that place. It was carefully verified by him.

CANIS GALEUS (BONAPARTE.) Tope.

Mr. Cresswell has caught large numbers with night lines, off Hunstanton. In the years 1872—3, he took more than a hundred.

Forty-five were caught at one time, two of which he kindly sent to me for examination measured over five feet long. All the females contained fully developed young ones more than a foot in length. The season at which these take a bait is in June and early in July, after which time they cease to be caught. Their food at this time appears to consist chiefly of crabs and starfish.

ZYGÆNA MALLEUS (Cuv.) Hammer Head.

Only one is mentioned as having been taken at Yarmouth, Nov. 24th, 1829. This is referred to in Messrs. Paget's list, and in Couch's British Fishes. The head and tail were presented to the Norwich Museum, by Mr. Dawson Turner.

MUSTELUS VULGARIS (M. & H.) Smooth Hound.

Norfolk Estuary.

FAM. II.—LAMNIDÆ.

LAMNA CORNUBICA (Gm.) Porbeagle.

Yarmouth.—P. Two examples. Mundesley.—“A large specimen, the skull of which is in the Norwich Museum.”—J. H. G.

ALOPECIAS VULPES (Gm.) Thrasher.

Yarmouth. Mr. Gunn reports the capture of one by the crew of a lugger engaged in the mackerel fishery, 4th July, 1867. Its total length was 14 ft. 5 in.; girth below pectoral fin, 6 ft.; tail, from tip to root, 7 ft. 4 in.

This species was first described by Dr. Caius, from a specimen stranded between Lowestoft and Pakefield (Suffolk) in February, 1570. Vide “De Canibus Britannicis,” &c., lib. ii. “De Vario- rum Animalium,” &c., p. 28.

SELACHE MAXIMA (Gunner.) Basking Shark.

Yarmouth.—P. The figure in Yarrell's work was taken from drawings of this specimen, sent to Mr. Yarrell, by Mr. J. H. Gurney.

Sir Thomas Browne says:—“This year (1662) one was taken entangled in the herring nets, about nine feet in length, answering to the last figure of Johnstonus, lib. vii, under the name of *Caius carcharius alter*; and was by the teeth and five gills, one kind of shark, particularly remarkable in the vastness of the optic nerves,

and three conical hard pillars which supported the *extraordinary elevated nose*, which we have reserved with the skull. The seamen call this kind a *scrape*."—Bohn's Edition, vol. iii, p. 326.

Dr. Günther thinks this is probably the same fish as that figured by Couch, vol. i, pl. 15, and which he takes to be a monstrosity of the Basking Shark (*Selache maxima*.)

FAM. III.—SCYLLIIDÆ.

SCYLLIUM CANICULA (L.) Lesser-spotted Dog-fish. (Rough Hound.)

Norfolk Estuary.—Specimen in Lynn Museum. Lowestoft.—J. H. G.

SCYLLIUM STELLARE (L.) Large-spotted Dog-fish.

Norfolk Estuary.

Yarmouth—P. Sherringham.—J. H. G. This specimen is in the Norwich Museum.

FAM. VII.—SPINACIDÆ.

ACANTHIAS VULGARIS (L.) Picked Dog-fish.

Norfolk Estuary. I have frequently met with small specimens of this species taken in trawl nets, but have never been able to observe those attempts at using its spines with such wonderful sagacity as Couch describes, p. 51. That they often inflict a wound when springing from the hand of their captor is not improbable, but that it is done with intention, intuitive perception, and mathematical accuracy described by writers, is contrary to all I have been able to ascertain by careful observation.

LEMARGUS BOREALIS (Scoresb.) Greenland Shark.

An immature specimen caught at Sherringham is in the Norwich Museum.—J. H. G.

FAM. VIII.—RHINIDÆ.

SQUATINA VULGARIS (Gray.) Monk-fish.

Paget mentions two which were taken at Yarmouth since 1817. One captured in the Norfolk Estuary by Mr. E. L. King, in 1865, measured 4 ft. in length, by 2 ft. 6 in. in breadth.

SUB-ORDER II.—BATOIDEI. FAM. I.—PRISTIDÆ.

PRISTIS ANTIQUORUM (Lath.) Saw-fish.

The occurrence of this species as a Norfolk fish rests solely on the authority of Sir Thomas Browne, who speaks of "a *pristis serra*, or saw fish, taken about Lynn, commonly taken for a sword fish, and answers to the figure of Rondeletius."

FAM. IV.—RAIIDÆ.

RAIA CLAVATA (L.) Thornback Ray.

Very common. This is named in Sir T. Browne's list.

RAIA BATIS (L.) Skate.

Very common.

This and the succeeding species are mentioned in the "L'Estrange Household Book," A.D., 1519 :—

"Item.—Flathe and Thornbacke, xijd."

Stödeler says that all the plagiostomi contain *urea* in their different organs—in fact in their whole body.—"Philosophical Journal," Jan. 1860.

RAIA MACULATA (Yarrell.) Homlin or Spotted Ray.

Common.

FAM. V.—TRYGONIDÆ.

TRYGON PASTINACA (L.) Sting-ray.

Mentioned in Sir T. Browne's list and in "Paget's list of Yarmouth Fishes." Mr. Elwes has taken it in the Norfolk Estuary, and Mr. Gurney mentions one, weighing about two stones, which he saw taken off Kessingland, Suffolk, September, 1856, which had a double spine. A similar instance is mentioned by Dillwyn (Fauna of Swansea) *vide* Couch; "British Fishes," vol. i, p. 133. T. E. Gunn records one from Yarmouth in 1869, 3 ft. 6 in. long, which weighed four stone.

FAM. VI.—MYLIOBATIDÆ.

MYLIOBATIS AQUILA (L.) Eagle ray

A specimen taken in the Norfolk Estuary is in the Lynn

Museum, and the skeleton of one found dead on Lowestoft beach, June 19, 1867, is in the possession of Mr. Harper, Chemist, Norwich.—T. E. Gunn.

SUB-CLASS V.—CYCLOSTOMATA.

FAM. I.—PETROMYZONTIDÆ.

PETROMYZON MARINUS (L.) Sea Lamprey.

Norfolk Estuary.

Mr. Lubbock says they are abundant in the Yare in April and May, when they run up to spawn.

Mr. Gurney has twice seen a large lamprey caught immediately below the "New Mills," at Norwich, and one of these two specimens is preserved in the Norwich Museum.

Mr. Bayfield mentions one, 28½ inches long, which was caught in Buxton Broads, June, 1873.

Sir T. Browne says, "Lampreys, great and small, found plentifully in Norwich river, and even in the city, about May; whereof some are very large, and, well cooked, are counted a dainty bit collared up, but especially in pies."

PETROMYZON FLUVIATILIS (L.) Lamprey.

Often caught at low water, in stow-nets, opposite Lynn, Norwich.—*Lubbock*.

PETROMYZON BRANCHIALIS (L.) Mud lamprey.

Keswick, near Norwich.—J. H. G. "Numerous in ditches containing small springs, to which these fish appear to be attracted."

II.

ON BREEDING LEPIDOPTERA IN CONFINEMENT.

BY F. D. WHEELER.

Read 29th of July, 1873.

I MAY premise that about two-thirds of this paper consists of extracts from my journals, and notes of my own experience in breeding ; of the remaining third, almost the whole is from information furnished in letters from Mr. W. H. Harwood, of Colchester, with one or two additions from those of other friends and correspondents.

To the best of my knowledge, no published treatise gives any clear or detailed account of that which forms the first and not the least difficult stage of this branch of Entomology, and which is almost exclusively the subject of the present paper ;—I mean the inducing moths to pair. Knaggs' "Lepidopterists' Guide" briefly touches upon it, but enters into no discussion on the subject ; and I recollect very well, that five years ago, when I first began to try my hand at breeding, my acquaintance with the matter was limited to a vague notion that you put a male and female together in a box, and then——But here, unfortunately, my ideas came to an abrupt termination, so I filled up the blank by inserting, "and then, why you got the eggs, and they all lived happily ever after, that is as long as they were wanted to live." Accordingly, as there is nothing like trying, I at once set to work. I got my box, first of all, nine inches square ; then I got my pupæ, and, thanks to the kindness of a friend, I was able to experiment on *Endromis versicolor* (the Kentish Glory)—rather a high flight for a beginning. I put the pupæ in the box, and the whole in what seemed to my inexperience a suitable place—viz., on the mantel-piece. The result may be anticipated. In January the moths came out, showed not the slightest symptoms of pairing, knocked themselves to pieces, laid a few unfertile eggs—and died. This was discouraging

certainly—but try again. They were Emperors this time and easier game, but the result was no better. In despair I came to the conclusion that attempting to pair moths was a most unprofitable speculation, and for that season gave it up. Now I don't mean to say that such a method might not have succeeded; there are some good-natured moths that seem determined to make the best of the most adverse circumstances, just as there are some larvæ which *won't* be starved by any amount of neglect. But there were several points about the plan which I soon found might be easily altered, and attention to which makes success, though by no means certain, yet far more probable. In the first place, it is *not* advisable to keep the pupæ warm, they are thus brought out before their time, and probably find the weather not sufficiently favourable to pair; or if fertile eggs be obtained, the larvæ hatch before their food is ready for them. And when the moths come out don't (if you can help it) keep them near a fire; the dry heat which is thus produced seems to be peculiarly bad for them, and many species, which pair readily out of doors, refuse to do so in such a position. It is far better to keep the pupæ out of doors exposed to the weather, and to let the moths remain there while pairing, or if that be impracticable, at least put them in a room without a fire or against an open window. And here I may mention, what might easily be guessed, that the state of the weather is of paramount importance. If the nights be warm, whether rainy or not, there is good chance of success, but should they be cold and windy nothing will stir. Of course by keeping the pupæ out of doors, we make it far more probable that they will not come out at all in such weather, but if they should, it is said to be better even to bring them in before a fire. This, however, is a desperate remedy, and I have never been successful with it, so that when a continuance of bad weather sets in, I give the thing up as hopeless. Next, as to the box. I need hardly say that the size mentioned above (9 in. square), is for such things as *Versicolor* and *Carpini*, far too small. As a rule it seems good to give the insects plenty of room, especially, of course, with the larger species, but I have more than once had a pair of moths, e.g. *Demas coryli* and *Notodonta cucullina*, which after refusing to pair in the breeding cage, have done so at last while undergoing the *peine forte et dure* of close confinement in a collar box.

I am told that it is an excellent plan to enclose the pair in a good sized muslin or leno sleeve on a branch, or even an entire young tree of the food plant, but this I have never been able to put in practice ; at all events it can do no harm, and may do good to insert a branch in water into the breeding cage. Again, Mrs. Hutchinson, of Lcominster, tells me that she always feeds the moths she is keeping alive for this purpose, as well as the impregnated females kept for laying eggs, by sprinkling the usual sugaring mixture on the leaves of the spray of the food plant, and that she finds it a very good plan.

While on this part of my subject, I must touch upon a point which has been much debated, viz., whether it is advisable to put in more than one of either or of both sexes. My own opinion is decidedly in the negative. I have always found that when I put in two males, the result was a great disturbance in the cage and nothing else, while if two females were present they seemed to distract the attention of the males, so that every trial ended in failure.

I may mention that it is extremely important that both male and female should be but recently emerged from the chrysalis. I once paired a *Trepida* female, which had been out five days, with a male just emerged, and the pair of *Cucullina* alluded to above as having paired in a collar box, had been out—the male four days, and the female six ; but as a rule, after two or three days, an insect becomes useless for breeding purposes.

Another frequent cause of failure is the fact that after being bred in and from the same stock, sooner or later, all moths refuse to pair. Some do so after the second, or even after the first generation, and all are more or less affected by it. In this case nothing remains but to mix the breed, either with those reared by some friend from a different stock, or still better by pairing with wild males. If the species occurs in the neighbourhood this may often be readily done—the *modus operandi* being simply to tie a piece of fine silk firmly round the base of one of the front wings, and having thus secured it to a tree where the insect is supposed to fly, to leave it all night. If the night be favourable, very often the male will be found with it in the morning, so that besides a batch of fertile eggs, you secure an additional specimen. Sometimes, however, a bat, or some such nocturnal marauder, will find

your female and make a meal of her instead ; but on the whole this is a very profitable method of pairing, as it wastes comparatively few specimens, and the eggs are almost certain to be fertile. I may mention that I have myself tried this plan successfully with *Palpina* and *Ziczac*, while Mr. Harwood informs me that he regularly pairs by this method many of the prominents, the kittens, &c.

Having said what I had to say on this subject generally, I will now proceed to the discussion of the several groups of British Lepidoptera. The Butterflies seem very impracticable ; *Machaon*, and I believe one or two others, have been made to pair in confinement, but they are very hard to manage, requiring much space, light, and generally the presence of the food plant.

The Hawkmoths are more easily managed ; the Privet-hawk, and all the *Smerinthi* pair without much trouble, and my friend Mr. Pickard, of Walsingham, has for six years past kept up a breed of *Elpenor* without any difficulty, by keeping them in a very large vessel with a growing plant of the willow herb. *Porcellus* will pair occasionally but not readily, and probably almost all this group, including the Clearwings and Burnets, may be induced to do so with a little management.

Of the Bombyces, some (as *B. quercus*) are proverbial for the readiness with which the virgin female attracts the male, and these are, of course, easily paired ; but others, such as the Emperor and Lappet, though they sometimes assemble readily, are very uncertain in confinement. As a rule, however, all this class may be expected to do very well, and they are favourites for breeding purposes, but many of them are not to be depended upon, and others, as *Demas coryli*, which seem to pair readily out of doors in a sleeve, are troublesome to manage otherwise.

Of Geometers, the large bodied species comprised in the genera *Enomos* *Amphidasis*, &c., are very easy to couple ; the *Selenidæ* (the true Thornmoths,) also pair readily, and some of the *Boarmidæ* will usually do so, but the rest, though many species have occasionally been known to pair in confinement, cannot, as a rule, be expected to do so.

The Hooktips are all of them very hard to manage, and the Rev. Bernard Smith (our greatest authority on the subject,) says that he has rarely succeeded in pairing them.

The Noctuæ are, as a whole, an exceedingly difficult class to deal with, though the genus *Tæniocampa* affords that exception which we are told is required to prove the rule. All the species of this genus except *Leucographa* (with the habits of which I am unacquainted,) pair with tolerable readiness, especially if placed in sleeves on the trees; indeed they may frequently be found coupled on the sallows. *Cymatophora ocularis* and *Ridens* have been successfully attempted, but not often, and my own endeavours to pair various species of *Acronycta*, *Cymatophora*, *Agrotis*, *Hadena*, *Diphthera orion*, &c., have all been complete failures, and I cannot often succeed even in obtaining eggs from caught females of the first two genera.

It remains to speak of the Pseudo-bombyces, the pet group of breeders. Nearly all of this class pair in confinement with more or less readiness; most of them have singularly beautiful and striking larvæ, and all are remarkable for the soft and delicate beauty of the imago, while by far the majority of species are of sufficient rarity to attract almost all collectors. Of these I may speak *seriatim*, as they are not numerous, and I have had personal acquaintance with twenty out of the twenty-seven British species.

The Dicranuridæ—the Kittens and Puss moth, are notoriously among the easiest species to pair, and with the proviso that the young larvæ are not handled, nor forcibly removed from their food plant, very easy to rear.

Fagi (the Lobster) is from its rarity not often tried for breeding purposes, but it pairs readily enough. Unfortunately, however, the larvæ are hard to rear, and even the pupæ sometimes die off, instead of coming out.*

Cassinea (the Sprawler) couples readily, but the larvæ must be kept separately, as they are somewhat apt to be too fond of each other, and having once acquired this depraved taste, sink at once into ferocious cannibals; the pupæ too are very apt to die *if disturbed*.

Of *Nubeculosa* I know nothing whatever as to pairing, but the larvæ are notoriously hard to rear.

* The same remark applies to this as to the last genus—viz., that the young larvæ won't bear removal from their food plant, but must be allowed to crawl from the old to the fresh food without assistance. The best plan is to sleeve out on growing trees.

The Bufftip is easy enough to manage, but not worth the trouble, when full fed larvæ may be had for the trouble of picking them up.

The Chocolate tips are all exceedingly easy to rear, and except when bred in and in from the same stock, easy to pair too.

Crenata has been taken only three times in this country, so I can't say anything about its habits.

Plumigera (the Plumed prominent) is very easily paired and is not generally hard to breed, though occasionally the whole brood will die off in a most mysterious manner.

Palpina, Ziczac, and Dromedarius, three of the commonest species, are also about the most easily managed, both in pairing the moths and in breeding the larvæ, and are decidedly the best species to begin upon, Ziczac, in particular, being easily obtained, and the larvæ very singular and beautiful.

Camelina, the commonest of all, is not quite so easy, and Dictæa and Dictæoides (the Greater and Lesser Swallow prominents,) are not very easy to couple, and the larvæ are not at all easy to rear, at least from the egg.

Trepida pairs very well, but its gorgeous larvæ is anything but easy to rear, especially when the plan of putting them out in sleeves on growing trees cannot be adopted.

Of Chaonia I have twice had pupæ, but in both instances there was an immense preponderance of females, so that owing to that circumstance, and to the length of time which elapsed between the emergence of the one solitary male and the first female, and also to the bad weather, I could not give them a fair trial, but I suspect they somewhat resemble their nearest ally, Dodonæa, which I have never succeeded in pairing. If you *can* get ova, however, of either species, they are not very hard to rear.

Carmelita, the queen of the prominents, as it has been justly called, from its wonderfully delicate beauty, is considered hard both to pair and to rear. I have never obtained pupæ myself until the present winter, but two of my friends have repeatedly succeeded in breeding it, keeping the larvæ and pupæ out of doors.

Cucullina (the Maple prominent,) also one of the most beautiful and by no means the least rare, is generally considered hard to pair in confinement, but I have bred it regularly since 1869, and have not found any insuperable difficulty with it, though I have every

season wasted many specimens in obtaining eggs ; while the beauty and rarity of the insect, joined to the singularity of the larvæ, amply repay any trouble that it may cost.

In conclusion, allow me to express my hope that some of those members, who have not yet tried their hand at this, one of the most profitable, as it is one of the pleasantest branches of entomology, may be induced at least to make a trial of some of my favourite Prominents, and that they will not give up in despair, if like myself they meet at first with ill luck, since one success will atone for several failures; and I suppose that it is only by repeated attempts that we can hope to acquire the skill requisite to ensure a fair proportion of profits.

III.

ON EMPUSA MUSCA AND OTHER MICRO-FUNGI.

By F. KITTON.

Read September 30th, 1873.

At the time of year when the more highly organized forms of life are fast dying and decaying, the simpler organisms are developed in vast profusion. When, in the beautiful words of Shelley,

“The warm sun is failing, the bleak wind is wailing,
The bare boughs are sighing, the pale flowers are dying,
And the year
On the earth her death-bed, in a shroud of leaves, dead,
Is lying,”

then the multitudinous variety of fungi make their appearance, “fattening on decay.” Let but the vigorous health of the plant or animal diminish or fail, and these vegetable scavengers make their appearance, appropriating the vital fluids of the lordly oak or the humble blade of grass with equal indifference ; nay, man himself, let but disease or physical weakness occur, and minute forms of fungi attack the ailing part. For example, the ringworm, so common

in children, arises from weakness of constitution, the ring-like scar indicating the presence of the mycelium of a fungus, the spores of which are nearly imponderable and at the same time almost indestructible; and when they meet with a soil suitable for their growth they increase with marvellous rapidity; a decline of general health, or perhaps a constitutional predisposition offering a suitable locality for their production.

The fungus found in the above-named disease is known by the name of *Microsporon Andonini*, and forms the light gray crusts covering the spot which has become bald. This fungoid growth consists of cylindrical tubes giving off decholorous branches, which when fully developed give off at their terminations a number of round bodies, (*sporidia*), varying from the 15,000 to 100,000 of an inch in diameter; the tubes vary from the 20,000 to the 25,000 of an inch in diameter.

If a hair is extracted from the diseased part the bulb will be found to be more or less invested with filaments and spores, some penetrating the membrane covering the basal portion of the hair; the epithelial scales on the bald portion will also be found covered with mycelium and spores.

Dr Küchenmeister in his "Animal and Vegetable Parasites," relates several cases of these fungoid growths penetrating the interior of the body, and in those cases committing ravages more destructive to vitality than when they occur on the external surface. He mentions the case of a patient who had long been annoyed with figures as of strings of pearls before his eyes, and upon the operation of parasection being performed a fluid escaped, in which was found a branched mass of small cylinders, partly filled with globules and partly covered with minute cylindrical processes. The fungus which occupied the entire interior of the eye was nearly colourless, and consisted of fine and coarse fibres with clear and uniform contents.

Helmhecht relates another case of a clergyman who came under his care for an inflammation in both eyes, after the cessation of which he had a constant movement of some body in the left eye, but after a fall from his carriage the figure became free. Helmhecht now made a puncture in the lower part of the cornea and sclerotic, a fluid escaped in which was found a branched mass, consisting of fungoid cells and rows of spores.

In the various kinds of skin diseases, fungoid growths invariably make their appearance, and in that horrible disease the *Polish plica*, *mycelia* and *sporidia* exist in enormous quantities. In fact no part of the body is free from the molestation of these minute spores, and if a weak place exist there they may truly be said to divide and conquer, for it is by self division that these minute forms increase and multiply. In those dangerous diseases *Apthæ* and *Diphtheria* the white patches seen in the mouth and throat will be found to consist almost wholly of fungus filaments interspersed with epithelial scales.

Having bestowed a passing glance on the fungi found on and in the highest form of life I will now call your attention to that form of fungoid development known as *Empusa musca*. Everyone has, without doubt, observed at this time of year the bodies of the common house-fly attached to the windows, pictures, and furniture in our houses, surrounded by a dense white cloud, from a half to one inch in diameter. The insect, although dead, and when slightly touched crumbling into a white powder, retains a life-like appearance, the proboscis is protruded and in contact with the surface upon which it is apparently resting, the legs extended, and the feet retain their adhesive property ; if we now examine the fly a little more closely we shall find the proboscis firmly adhering to the glass, in fact I have sometimes detached the body leaving the whole of it attached to the surface ; if we now inspect the fly with a lens we shall observe that the body is swollen almost to bursting, every segment is stretched to its fullest extent, and externally seems to have been floured ; if a portion of the abdomen be detached and examined under the microscope we shall find the whole of the internal organs have been absorbed by the growth of the fungus, and nothing left but the interlacing fibres of the mycelia.

I have from time to time examined flies in various stages, and when the insect appears languid and unwilling to move we may feel assured that the fungus has begun to develop, and on dissection the fluid that fills the spaces between the viscera will be found to have greatly increased in quantity and filled with fatty drops, and innumerable minute cells filled with granular matter. These cells rapidly increase in size, and if supplied with sufficient nutriment retain their spherical outline, but as the fluid decreases in quantity or nutritious value they begin to elongate, and assume the form of longer or shorter

tubes. A short time previous to death all movement ceases and the body becomes turgid, in consequence of the greatly increased development of the fungus cells, some of which are very large. The cells now regain their globular outline, at one or two points filaments are formed, which interlace and throw out branches, and gradually surround the internal organs, but do not appear to penetrate them; they however soon appear to obtain nutriment at their expense, and finally death ensues, the legs and wings become extended, the proboscis obtruded and adhered closely to the glass, &c. The fluids and internal organs are gradually absorbed by the fungoid parasite, the radial portion continues to elongate, and the opposite end gradually develops a clavate head, the internal growth of the *Empusa* enlarges the abdomen and the segments separate from each other; after the lapse of several hours the delicate membrane uniting the segments is perforated by the clavate ends, which now make their appearance on the external surface, forming white rings round the abdomen, the clavate end grows quickly, a delicate diaphragm is formed at the lower extremity; the parasite now consists of two cells, the upper portion becomes filled with plasm and a mucellular spore is formed which the elastic pressure of the cell projects some little distance from the parent cell; these spores form the white halo surrounding the body of the fly.

Some observers attribute the presence of the *Empusa musca* to a vitiated condition of the circulating fluid, as the true spores have not been detected in the fly. Perhaps the protoplasm that formerly replaced the wasted tissues is no longer appropriated and develops into a lower organism, which in its turn pulls to pieces the former material.

Others are disposed to think that the spores attach themselves to the exterior of the fly, and when favourable circumstances occur for their development they penetrate the spiracles, and the growth of the *Empusa* commences. Dr. Cohn considers this disease to be analogous to the muscardine in the silkworm, but as I have not had an opportunity of seeing that disease, I am unable to give any opinion as to the correctness of the doctor's views.

I have endeavoured to produce the fungus in other insects—viz., the blow-fly, the bee, and drone fly, but without success. The plan I adopted was to confine the insects under a glass in which one or more dying or dead flies were placed, but in no instance was

the *Empusa* developed in the living insect. I do not remember ever seeing the blow-fly attacked by this disease.

The Micro-fungi are perhaps the most remarkable of all the simpler forms of life, and although so delicate, we have, I think, undoubted traces of their existence as early as the chalk period. Many years ago a paper, by my old friend Mr. Rose, was read before the Microscopic Society of London, calling attention to the traces left by some species of fungoid parasite permeating the scales of *Beryx ornatus* found in the chalk. Many years after, Professor Kölliker detected similar traces in the horny skeleton of a sponge, and in various species of foraminifera, a parasitic growth frequently occurs; nor are the shells of the mollusca safe from the fangs of a vegetable parasite. I have frequently observed it in fragments of shells found in dredgings from various localities, and similar ramifications are almost invariably to be found between the laminae of the shells of the chalk *terebratulæ*.

Glass seems particularly liable to the growth of the mycelia of some species of fungus. The inner surfaces of lenses composing the object glasses of telescopes, if not cemented together by Canada balsam, are often much impaired by the growth of some kind of micro-fungus, and in fact permanently injured, as the surface of the glass becomes eroded. Thus not only does organic matter become the prey of parasitic organism, but even inorganic cannot escape scathless, but we find that destruction of one form of life results in the construction of some other phase of organic existence.

“How all things live and work and ever blending,
Weave one vast whole from beings ample range;
How powers celestial rising and descending,
Their golden buckets ceaseless interchange;
Their flight, on rapture-breathing pinions winging
From heaven to earth their genial influence bringing,
Through the wide whole their chimes melodious ringing.”

(Goethe.)

IV.

ON THE NIDIFICATION OF THE PROSOPIS.

BY J. B. BRIDGMAN.

Read July 29th, 1873.

THE nidification of this little bee has been a partial mystery, for not being supplied with polleniferous organs, it was difficult to see how it could convey pollen to its nest. Kirby passes over the subject by saying, "it has no apparatus for conveying pollen." In his time the history of parasitic or cuckoo bees was not known, all he knew of them was that they were caught flying about banks; had he known their history, no doubt he would, as others did after him, have given this bee the credit of making one of that subdivision.* Since then, Mr. Smith has published his "Bees of Great Britain," in which he says that "Mr. Thwaites in 1841 bred them from dead bramble sticks, in which they had formed a nest in the same regular order as the acknowledged constructive species; that afterwards Mr. Sidney Saunders bred an Albanian species in profusion from bramble sticks, which they line with a thin, transparent membrane, calculated for holding the semi-liquid honey, which they store up for their young." Mr. Smith afterwards says, in the "Entomologist's Annual," that the cells in the brambles are like the cells of *Colletes*, but without any space between them, which the latter generally have. In his book he also says he had a nest given him, where the insect had formed its cells in a stone. Shuckard says, "they have usually been considered as parasitical insects, and the circumstance of their having been bred from brambles is no proof of their not being parasitical, for many bees, for instance, *Ceratina* and *Heriades*, &c., nidificate in bramble

* I had overlooked a note in the *Apum Anglium*, on the "*Melecta punctata* Kirby," in which he says, "ova deponis, uti suspicor, in cellulis *Apis retusæ*, *Cuculus* Apum," which clearly shews the true history of the cuckoo bees had begun to dawn on that very close observer.

sticks, and they may have superseded the nidificating bee, by depositing their ova in the nests of the latter, although it certainly is a remarkable circumstance that some one of these bees has never escaped destruction in the several instances in which they have been thus bred." This seems to me to be a far-fetched idea, as *Prosopis* are comparatively common, and the two bees he mentions are rare, one particularly so. I have this season bred, I suppose, about forty of, I think, three different species from bramble sticks, and as I opened the sticks and exposed the cells, am able to say there was no other bee in my cells. This is all I have found of the history of these little bees, but accident has enlightened me a little on their economy. During the winter, whilst digging out some cells of *Colletes* on Mousehold from a hard sandbank, I found a series of three cells of, as I hoped, the rare little *Colletes marginata*; the cells were very like *Colletes*, only without the space generally found between the cells of the latter, and were white, but I was doomed to disappointment, for instead of *C. marginata*, I reared *Prosopis signata*. At Poringland, in digging out *Colletes*, I again came upon the *Prosopis*, but this time in some old cells of *Colletes*, of which the insect had availed itself, as I have found *Osmia rufa* do with old cells of *Anthophora acervorum*. At Harford Bridges, I saw some small black bees flying about a hard sandbank, and settling just like *Halictus*, for which I at first took them; I caught some, and they proved to be two species of *Prosopis*, both sexes; I afterwards saw one of *P. signata* enter a hole at the same place. One evening when I knew they would be at home, I dug out some of the holes I found in the bank, and, as I expected, found *Prosopis*, and at the bottom of two of the burrows, behind our insects, two males of a small *Halictus*. I also found another nest in the same place, with the cells formed in an old boring of *Colletes*; the insects were all gone. I also found several old nests, which there is no mistaking, as these two bees, *Colletes* and *Prosopis*, are peculiar in being the only two genera of bees that have obtuse instead of acute tongues, and are the only two that plaster their tubes with a peculiar gold-beater's-skin-like substance, for which their tongues are admirably adapted. I have also found these bees, both male and female, with their heads out of the burrows, amongst a colony of *Chelostoma campanularum*, (a small bee that burrows in posts and rails,)

which have formed a rather large colony in the palings by my garden.*

From the above observations, I think we may conclude that these bees form their nest in any suitable situation, whether in soft wood or earth, not even despising ready formed holes. At the bottom of one of the cells in the bramble sticks, I found a hard half-round pellet of some yellow substance, which, under the microscope, turned out to be a mass of regular oval shaped pellets, closely and carefully packed together, evidently of pollen and honey mixed, each pellet covered with the same gold-beater's-skin-like secretion. Now, as the bee has no special organs for collecting pollen, I fancy it must have collected and carried it home in its mouth, after working it up into a pellet. The bee had either forgotten to lay its egg, or the egg had died ; it does not matter to us much which, but it has enabled me to state that this bee does collect pollen, like almost, and perhaps all other constructive bees.

* Since the above was written, I have discovered another proof of this being a constructive bee. In the cells of *Colletes* some are opaque red, and others transparent white ; it struck me the opaque ones contained the *Colletes*, and the transparent ones the parasite *Epeolus variegatus*, so I separated the remainder of my unhatched cells, to see if it were so, when, to my surprise, amongst the *Epeolus* hatched from the transparent cells, I found a female *Prosopis*, and on hunting over the empty cells to see where she came from, I found an appropriated cell of *Colletes*, in which the little bee, finding the cell as it was too large for its purpose, had, rather than fill it up to what it wanted, divided the cell from side to side, not straight across, but in a slanting direction, and by this means, with as small an amount of labour as possible, out of one old cell constructed two, which admirably served its purpose ; in the further cell of the two thus formed is the dead larva.



V.

NOTES ON THE METEOROLOGICAL OBSERVATIONS

RECORDED AT NORWICH, DURING THE YEARS 1870 TO 1873.

BY JOHN QUINTON, JUN., ASSISTANT SECRETARY.

HAVING been requested by the President and Committee to write a paper on the weather of the last four years, I have much pleasure in presenting the following summary, with remarks on the most noteworthy meteorological phenomena, which I think worth putting on record in the Transactions of the Norfolk and Norwich Naturalists' Society.

It will be seen, for example, that in some cases we have to recur many years for similar observations, some having rarely occurred during this century, as, for instance, the low temperature of November, 1871, followed by the long high temperature in January and February, 1872; also, the unusual barometric depression of January 24th, 1872, and the great difference of temperature between January and February, 1873.

The instruments from which the observations are taken, are a standard barometer, and a rain gauge belonging to the Norfolk and Norwich Literary Institution; the former is 41.5 feet above mean sea level, and the latter 30 feet above the ground. The temperature observations are from dry and wet bulb thermometers, and a maximum and a minimum thermometer, belonging to the Norwich Meteorological Society; the wind observations are from the Norwich Anemometer, erected by the same Society in 1869. All the barometric observations are reduced to 32° F. at sea level. Owing to the want of space and time, I have this year confined myself to the record of facts observed here, but hope in future years to be able to compare our record with the general meteorology of the country.

1870.

The first nine days of December, 1869, were cold, but were succeeded by a mild fortnight, with S.W. gales, and heavy rainfall; a strong gale from the W. and N.W. was recorded on the 16th, when the barometer fell to 28.717, and the velocity of the wind was from 25 to 30 miles an hour. On the 24th a cold period commenced, the thermometer registering its minimum 17.5 on the 29th. The rainfall was the greatest amount recorded for December during the last thirty years; it amounted to 4.22 inches, being 2.21 above the average, but was succeeded by a very long drought, the deficiency in January and February was .31 and .57. On the 1st of January the temperature rose 9 degrees, and unusually mild weather, with S. and S.W. winds, was recorded until the 17th. The aurora borealis was seen on the 3rd. On the 8th a strong S.W. gale was recorded, the velocity was 453 miles in the twenty-four hours, and the barometer fell to 28.943. From the 18th to the 30th the days were again cold. On the 31st the temperature increased, and mild weather lasted until February 8th, when the thermometer again fell below freezing; the cold weather continued for fourteen days, attended by strong E. winds. On the 24th the temperature increased, and warm days were recorded until March the 3rd, when the thermometer fell 14 degrees. A strong N.E. gale was recorded on the 4th and 5th; and, with the exception of the 16th, 17th, and 21st, cold, unseasonable weather was recorded until the 5th of April. The rainfall for March was 3-10ths below the average. On the 5th of April the cold weather disappeared, and was succeeded by a long period of fine and unusual dry weather, the rainfall being .92 deficient in April, and 1.35 in May. The thermometer registered 80 on May 21st, and as high as 86 on 22nd of June; on the 23rd of June, however, the maximum was only 65, and ten cold days followed; the rainfall for June was half an inch below the average; it was also deficient half an inch in July, and 1-10th in August. From the 4th of July to the 18th of August the weather was very fine and mild. A thunderstorm, with heavy rain, occurred on the 18th, and was followed by a strong N.W. gale on the 19th; a strong gale rose on the 28th, and lasted two days, the velocity was 348 miles on the 28th, and 373 on the 29th.

From the 19th of August to September the 14th the days were cloudy, with frequent showers of rain, amounting to 3.39 inches. After the 15th of September the weather was very fine and bright, and no rain fell until October the 7th. A magnificent display of the aurora was seen on the 24th. The September rainfall was 7-10ths deficient. October was a stormy month, with a rainfall .75 in excess of the average. Brilliant displays of the aurora borealis were seen on the 24th and 25th. This month was most remarkable for the barometric variations; on the 1st 30.621 was registered, after which it fell to 28.840 on the 9th, it then rose to 29.843 on the 11th; this was succeeded by a variation of from 7 to 8-10ths of an inch every two days until the 21st, when it again fell to 28.805 on the 24th, after which increased readings were recorded. A strong gale from the S.W. raged on the 13th. On the 31st of October the wind changed to N.W., and a period of cold weather commenced, which continued until the 19th of November; the remaining days were much warmer. November was unusually dry, the rainfall, which only amounted to 1.16, was 1.08 below the average. December commenced with a period of very cold weather, accompanied with snow and sleet, which continued until the 11th; nine warm days followed. On the 20th the wind changed to E.N.E., and a remarkably sudden fall in the temperature was recorded. The minimum temperature on the 20th was 42°; 21st, 28°; 22nd, 22°; 23rd, 17°; 24th, 8°; and on the 25th, 5.5; the maximum temperature on Christmas Day was 12 degrees below freezing. The mean temperature of the eleven days ending the 31st was 24.4, and is considered to be the lowest of any period of similar length since February, 1855. The rainfall for this month was .95 above the average. The rainfall for the year was 18.87 inches, the smallest annual fall since 1864, when only 14.62 was recorded.

1871.

January, 1871, was a very cold month, the mean temperature being only 31.8; frosts occurred on twenty-four nights. On the 2nd the minimum temperature was 14° below freezing; and on five days the thermometer never rose above 32°. The rainfall was 4-10 deficient. The aurora borealis was seen on the 13th. A strong S.S.E. gale was recorded on the 16th, when the barometer

fell to 28.879, the minimum reading for the year. February was a cloudy month, with a rainfall 8-10 in excess of the average. The weather was unusually mild, except on the 11th, when the minimum temperature fell to 12° below freezing. March was mostly remarkable for the sudden alternations of temperature, more especially in the day temperatures. The maximum on the 1st was only 38.5, but on the 3rd it registered 59.0. On the 15th the day temperature fell to 40.8, and on the 25th reached 68.2, but again fell to 42.5 on the 28th. The rainfall was 6-10ths deficient. The first eleven days of April were cold and dry, only .13 of rain fell. A brilliant aurora was seen on the 9th. From the 12th to the 30th the weather was much milder, with excessive rainfall, amounting to 2.94, causing the monthly total to exceed the average by an inch and a half. The first three weeks of May were cold and cloudy, with a mean temperature of 46°; the last week was milder, with a mean temperature of 54°. Rain fell on only eight days, and was 6-10ths deficient. Thunderstorms occurred on the 25th and 27th. June was a very cold and stormy month, the mean temperature was 4.3 below the average of the last thirty years. A N. and N.N.W. gale occurred on the 6th, 7th, and 8th, when the daily velocity of the wind was 338, 438, and 346 miles respectively. The thermometer rose to 79° and 77° on the 15th and 16th; a thunderstorm occurred on the latter day. The rainfall was .47 above the average. July was like the preceding month, cold and cloudy, with frequent though small showers of rain, which was only .05 deficient. Thunderstorm on the 23rd. August and the first sixteen days of September were very fine, the days mostly bright and cloudless, very little wind, and the heat sometimes very oppressive; on four consecutive days, the 10th to the 13th of August, the thermometer registered above 80°. Rain fell on only two days in August, and was an inch and a half deficient. Severe thunderstorms occurred on September the 2nd and 6th. The last week of September was remarkable for its excessive rainfall, which amounted to 3.18 inches, 1.64 of which fell in the twenty-four hours ending ten, a.m., the 30th; the monthly total (4.02) was nearly 2 inches in excess of the average. Considerable oscillation was recorded in the barometer during the last week. October was a fine mild month, the mean temperature about its usual value; the winds very light, chiefly S. and S.W., and the rainfall 1.16

deficient. This was succeeded by an unprecedentedly long period of cold weather, lasting until December the 12th; the mean temperature of November was only 37.5. Mr. Glaisher says this was the most severe November since 1786. For the first eleven days of December the mean was only 30.0; on the 8th of December the minimum temperature was 23° below freezing, and the maximum 5.8 below. A very brilliant aurora was seen on the 10th of November. A strong gale from the N. on the night of November the 30th. The latter part of December was much milder; no frost occurred after the 12th. The barometer fell rapidly to 29.282 on the 20th, followed by a severe gale from the N.W., but of short duration. The rainfall for November was 4.10 deficient, and the same in December; the total fall for the year amounted to 23.13 inches, being 0.45 below the average.

1872.

The cold winter which broke up on December the 12th was followed by an unusually long period of mild weather, the mean temperature for January and February being 39.5 and 42.1, therefore the two months averaged 40.8. Mr. Glaisher says this has only been twice exceeded in the last hundred years, viz., 1846 and 1869; he considers it very remarkable by following the long period of cold weather ending December the 11th. January was a cloudy, wet month: rain fell on nineteen days, and was 1.25 in excess of the average. Heavy gales from the S. were recorded on the 4th and 5th, 17th and 18th; and on the 24th, the day of the great barometric depression, when the greatest hourly velocity was 27 miles, and the total for the twenty-four hours, 374 miles. This month was most remarkable for the great variation in the barometer; on the 24th it registered 28.397, the lowest pressure recorded since January the 13th, 1843, when 28.205 was recorded. Great oscillation occurred throughout the month, and the readings averaged as low as 29.621. February was a cloudy month, but very mild; only two nights of frost occurred. Prevalent winds, S. and S.E., and generally light. Rainfall was 6-10ths deficient. The mean temperature of the first seventeen days of March was 46.0, the maximum, on the 17th, was 59.0. Nine cold days followed, with N. and N.E. winds, accompanied by frequent storms

of snow, hail, and rain, the temperature averaged only 36.8 ; the maximum on the 21st was only 38.0. The last three days averaged 48.0. The rainfall was 3.02, twice the usual amount. Considerable variation in the thermometer was recorded during April ; the day temperature varied 23 degrees, the extremes being 45.0 on the 3rd, and 68.0 on the 12th ; the night temperatures 22 degrees, between 27.0 on the 20th, and 49.0 on the 28th. The mean weekly temperatures were 42.8, 48.2, 43.3, and 47.9. A gale from the N.W. was recorded on the 8th and 9th ; and on the 16th, 17th, and 18th, when the daily velocity was 324, 336, and 304 miles respectively. The rainfall was 6-10ths in excess. May was a cold and cloudy month, the mean temperature only 49.9 ; the rainfall was .23 deficient, being the only other month besides February when it did not exceed the average. A S.W. gale was recorded on the 4th, and a N.E. on the 13th. Thunderstorms occurred on the 7th and 8th. The average temperature for June was high, but the days were generally cloudy, with frequent showers of rain, which exceeded the average by .73 in. The temperature for the first fortnight averaged 54.0, and for the last 61.0. Thunderstorm occurred on the 24th. The weather during July was very changeable, composed of short periods of alternately low and high temperatures. The mean temperature of the first three days was 61.0 ; from the 4th to the 8th it averaged 69.3 ; from the 9th to the 19th only 61.0 ; this was succeeded by excessively hot weather, the mean for the next nine days was 71.5. The winds were very variable, but light ; several thunderstorms occurred, and the rain was 6-10ths in excess. August was a cold month, sky generally cloudy, with very variable light winds, and the rainfall .47 above the average. September was composed of a mild and a cold fortnight ; the mean temperature for the first two weeks being 61.3, and for the last two only 49.2. The winds were chiefly W. and S.W. ; a strong S.W. wind lasted from the 25th to the 28th, when the daily velocity was 368, 303, 329, and 324 miles respectively. The rainfall was slightly in excess, being .14 above the average. Although the wind was chiefly S. and S.W., October was a cold, ungenial month : rain fell on twenty days, exceeding the average by .48 in. The two last months of the year were most remarkable for the excessive rainfall, which amounted to 7.60 inches, being 1.53 in excess in November, and 1.85 in December,

causing the fall for the year to be 32 inches, the greatest amount recorded in the last thirty years. Both months were unusually mild, chiefly owing to the high night temperatures, which averaged 38.0 in November, and 36.0 in December; only three nights of frost occurred in November, and eight in December. Several strong gales were recorded during November; the daily velocity, with a S. and S.W. wind, from the 23rd to the 27th, was 361, 296, 306, 389, and 350 miles respectively. Considerable oscillation occurred in the barometer readings during December, they averaged remarkably low, (29.581) and no instance of their reaching 30 inches was recorded. On the 9th it fell to 28.802, on which day a heavy S.W. gale occurred; 464 miles were registered, 323 of which were traversed in the first twelve hours. The total fall of rain for the year was 8.41 inches in excess of the average.

1873.

The new year began with an almost unprecedentedly high temperature, the mean for January being 40.6; no frost was recorded until the 19th, the average temperature for the first eighteen days was 44.2; the remaining days were much colder, the last week averaged only 33.0. Several strong S. and S.W. winds were recorded, with considerable oscillation in the barometer, which fell as low as 28.477 on the 20th. This depression was most remarkable for lasting so long; the readings were below 29 inches during the whole of the 19th, 20th, and 21st. The rainfall was .45 in excess of the monthly average. February was a cold, bleak month, with frequent showers of snow, sleet, and rain; the mean temperature was 6.4 below that of January, and twenty-one nights of frost were recorded. A difference of so many degrees between January and February is very rare. Mr. Glaisher says it has only been exceeded once in the last hundred years, i.e., in 1853, when the mean temperature at Greenwich for January was 42.4, and February, 33.3, a difference of 9.1. The rainfall was .58 in excess. A strong N.E. gale was recorded on the 7th and 8th, when the daily velocity of the wind was 320 and 366 miles; and a N.W. gale on the 27th, when 339 miles were traversed. The barometer pressure averaged high until the 18th, when the unusual high

reading of 30.775 was recorded ; a fall to 29.8 on the 22nd followed, succeeded by a rapid fall on the 25th and 26th to 28.817 ; after which the pressure quickly increased, and 29.8 was registered on the 28th. The temperature for the first and last weeks of March was high, averaging 40.9 and 41.7 ; the two intermediate weeks were cold, the mean being only 36.6 and 36.8. The rainfall was slightly in excess of the average. A severe E.N.E. gale occurred on the 15th and 16th, when the daily velocity was 334 and 358 miles. The prevalent winds for April were N., causing the temperature to average low, but it was a month of considerable alternation of temperature. The mean for the first five days was 47.0 ; from the 6th to the 13th 42.0 ; a considerable increase of temperature followed, the thermometer registering 63.5 and 62.5 on the 15th and 16th, and the mean from the 14th to the 22nd was 48.4. This was followed by a long period of cold weather, the mean for the remaining days being 40.9, and for the month of May only 48.0. The velocity of the wind on the 27th of April was 414 miles from the N.W. The rainfall was .49 deficient in April, and .67 in May. A N. gale was recorded on the 17th, 18th, and 19th of May, when the daily velocity was 325, 299, and 345 miles respectively. June was a fine, dry month, the winds for the first week N. and E., remainder of the month chiefly S. and W. ; only .92 in. of rain fell until the 29th, when .99 in. fell between 8 p.m., the 29th, and 1 a.m., the 30th, this was the greatest fall for the year. The temperature for the first nineteen days of July was rather low, averaging only 59.3. The maximum on the 19th was only 67.2 ; the thermometer rose 13 degrees the next day, and was followed by three excessively hot days, the maximum of which was 86.0, 86.5, and 92.0. On the 24th and 25th 76.5 and 80.5 were registered, and on the 26th only 67.0. The winds were light, chiefly from the S., S.W., and W. ; the rainfall amounted to 1.98, 9-10ths of which fell on the 13th, the monthly fall was 4-10ths deficient. August was a fine month, with rainfall 4-10ths deficient. The month was remarkable for the alternation of the day temperature, although there was little variation in the direction of the wind, it being W., S.W., and S., on twenty-seven days. The maximum temperature on the 1st was only 69.5 ; on the 8th it rose to 82.5 ; but on the three following days the thermometer only registered 66.0. On the 16th 81.5 was recorded, and on the 19th only 62.0 ;

on the 25th it again rose to 78.5, followed by a fall to 60.5 on the 29th. September was an unusual cold month, the mean temperature being only 53.0, 7.8 degrees below that of August. A thunderstorm with 9-10ths of rain, occurred on the 1st. The first fifteen days were very cloudy, with an excessive rainfall, amounting to 3.09, an inch above the monthly average. This excessive rainfall was succeeded by a long drought, no rain fell in the last fourteen days; and only 3.44 was recorded during the last three months, being 8-10ths deficient in October, 1.17 in November, and 1.54 in December. October was a cold month; days generally overcast; several thick fogs occurred in the last week. A sudden rise in the temperature occurred on the 10th; the maximum and minimum on the 9th were only 52.0 and 31.0, but on the 10th the maximum was 66.0, followed by a night temperature of 57.0. A S. gale of 364 miles was recorded on the 11th. A strong S.W. wind blew on the 20th, 21st, and 22nd, attended by a fall in the barometer, which registered the minimum, 28.887, on the 23rd; after which an unbroken rise was recorded, to the maximum, 30.476, on the 28th. November was a fine, mild month, with a mean temperature of 43.0; considerable oscillation occurred in the barometer, especially in the last week, when several high W. and S.W. winds were recorded. December was remarkable for its high barometric pressure; preponderance of S.W. winds; small rainfall; and, with the exception of the second week, high temperature. The mean weekly temperatures were 41.4, 35.4, 42.6, and 41.7. The barometer readings averaged 30.5 for the first thirteen days, after which the pressure decreased, and the temperature increased, the thermometer registering 56.0 on the 16th, and the barometer 29.668; on this day a S.W. gale of 374 miles was recorded. The barometer readings for the month averaged at the unusual height of 30.246; and with the exception of the 6th and 24th, when the wind was N.W., the winds were entirely S., S.W., and W. The rainfall only amounted to .43, the smallest quantity recorded for December since 1857. The rainfall for the year amounted to 20.36 inches, being 3.22 below the average.

VI.

MISCELLANEOUS NOTES AND OBSERVATIONS.

MAMMALIA.

BY T. SOUTHWELL.

PARTICOLOURED BAT *Scotophilus (vespertilio) discolor*. Mr. Newman, in his "Collected Observations on British Bats," mentions the occurrence of this rare species off the Norfolk coast, on the authority of Mr. John Hancock, of Newcastle. Mr. Hancock has kindly given me all the information in his power as to this specimen, which, however scanty, conclusively proves its locality. It was taken in 1834 on board ship off the Yarmouth Roads, and when given to Mr. Hancock, in whose possession it still is, was either alive or just dead. The only other known British example is, I believe, a specimen in the British Museum, taken at Plymouth by Dr. Leach, and it appears probable that in both instances they were conveyed to this country on board some foreign vessel; both these specimens being immigrants I do not think the species can properly be considered as entitled to a place in the British List. It would be interesting to know if the Yarmouth ship was from abroad, and if so, from what port, but as Mr. Hancock's friend has been dead some years, it is impossible to learn now. This species appears to be nowhere very numerous. Lord Clermont says it inhabits South Germany, Silesia, Denmark, and the Bukovina, many parts of the Alpine chain, Dalmatia, Hungary, and the eastern parts of France. Neither Jenyns, Bell, nor Lord Clermont give the date of the Plymouth specimen.

TENACITY OF LIFE IN LEPISMA SACCHARINA. (LINN.)

BY J. B. BRIDGMAN.

A circumstance has come to my knowledge showing the remarkable tenacity of life exhibited by this insect. More than two years ago, a gentleman given to microscopic pursuits placed a *Lepisma* in a box, marking the name and date upon the lid; this was intended for a friend, but was put on one side, and remained

undisturbed and forgotten for two years, when happening to see the box, to his great surprise upon opening it, the *Lepisma* was found as lively as if only just put in, and apparently none the worse for its two years solitary confinement without food and light, and with very little air. One would like to know the length of life of these insects.

FURTHER NOTE ON THE SPONGEOUS ORIGIN OF FLINTS.

BY F. KITTON.

(See 1871—72, p. 59.)

In my paper on the above subject (published in the Transactions for 1871—72) I gave a figure (page 59, fig. 2) of the microscopic structure of a sponge-like organism from the greensand, Carrow, Norwich. Since its publication I forwarded specimens to H. J. Carter, Esq., F.R.S., and he pronounces it to be a new species of sponge, belonging to the Lithistidæ, and has described and named it as follows, *Lithospongitis kittonii*.—Carter. "Fossil species in which the surface spicule is not known, but in which the body spicule has a branched filigreed form, Carrow Hamlet, Norwich."—"Annals and Magazine of Natural History," vol. xii.

Through the kindness of Mr. Carter I have been enabled to compare it with a recent form (*Corallistes borealis*—Carter) in which the siliceous skeleton (body spicules) has a similar tubercled appearance as *Lithospongitis kittonii*.

ORNITHOLOGICAL NOTES FOR 1873—4.

BY H. STEVENSON, F.L.S.

SEA EAGLE (*Haliaeetus abicilla*.) A fine young male was shot at Stokesby, near Yarmouth, on the 22nd of April, having frequented the neighbourhood for some days.

WHITE-WINGED BLACK TERN (*Sterna leucoptera*.) Of this species, until lately one of the rarest terns in the British List, five specimens were killed out of a flock of seven, at Hickling, near Yarmouth, on the 30th of May, and several more were said to have been seen.

WHITE STORK (*Ciconia alba*.) A fine bird was shot at Potter Heigham, near Yarmouth, on the 5th of June, probably the same which had been seen shortly before in the adjoining county.

SPOONBILL (*Platalea leucorodia*.) Notwithstanding the New Act, five of these interesting birds were shot on Breydon during the past summer, one in May, and four early in June.

LITTLE GULL (*Larus minutus*.) An immature specimen was shot near Yarmouth about the middle of August.

KINGFISHER (*Alcedo ispida*.) On the 6th of June, when the young birds were able to fly, I examined a nest of this species, bored into the face of a large clay pit, about two feet six inches from the top of the jamb, and partly concealed by the overhanging grassy summit. This pit is in the parish of Keswick, near Norwich, and some two hundred yards from any stream. It is in the same neighbourhood as the nest I examined in 1863, as described in the first volume of the "Birds of Norfolk," (p. 317,) and which was situated in the bank of a meadow drain. The present nest contained six full fledged young, with the feathers on the top of their heads much matted with the soil, which had dried on. The chamber itself was domed, four inches deep by six inches wide, and just the height of the nestlings, and from the mouth of the hole to the back of the nest was nearly twelve inches. On the floor were a very few fish bones, but no other lining of any description, which confirms my impression that in new nest holes the eggs are laid on bare soil, and that the fish bones accumulate gradually, by the castings of the birds, but I am at a loss to account for so small a layer of bones by the time the nestlings were ready to fly. I have no doubt the previous nest I examined had been used for several seasons, as perfect walls of dried fishy matter had formed round it, and still more recent deposits were heaving with maggots. In this case, except close to the entrance, (which had decidedly "an ancient and a fish-like smell,") the nest was perfectly sweet, and the fish bones white and dry. The entrance hole measured three inches by two inches in width. I have no question that this nest was made by the birds themselves, and not adapted from a sand-martin's or other boring. Many small fish, which had been dropped by the old birds, were lying at the bottom of the pit, and it is

believed that for two or three seasons the same pair have nested lower down, at the extremity of a rabbit's burrow.

The following interesting note, confirmatory of the migratory habits of the kingfisher, has been sent me by Mr. J. H. Gurney. "About the 13th of September several were observed on the beach at Blakeney, and on the 14th, a single bird was seen flying by the edge of the waves at Cromer, which perched on a breakwater." Our bird stuffers received several specimens at that time, and in the two following months.

GRAY PHALAROPE (*Phalaropus lobatus.*) I am indebted to Mr. J. E. Harting for one of the most interesting specimens of this bird in my collection, from the intermediate state of its plumage, partly summer and winter. The date of its appearance, on the 12th of September, is unusually early, and that it was a chance straggler seems probable from its being quite alone, swimming about in a small "plash" of water on the Breydon "flats," and that no others have since come to my notice. As usual, it showed no apprehension of danger when approached. I have never seen an example of this species, killed in Norfolk, with so much of the summer plumage still remaining.

OSPREY (*Pandion haliaëtus.*) A young male killed on the 13th of September, at Potter Heigham, near Yarmouth, was sent me on the following day, and was, I fear, the same bird which had been seen at Ranworth, and one or two neighbouring localities during the previous week, carrying off fish from the broad waters.

EARLY APPEARANCE OF THE FIELDFARE (*Turdus pilaris.*) Major Irby sent me, in the flesh, on the 20th of September, a fieldfare shot by himself on the 17th. This early arrival shows no mark of immaturity, and from the appearance of the breast-bone, it was in all probability a last year's bird. Mr. Irby also informs me that he saw two at Boyland about the 7th of June, but could find no nest.

CRANE (*Crus cinerea.*) I am indebted to Mr. S. K. Gayford, of East Wretham, for the following particulars respecting a crane killed on a farm in his occupation on Mr. Birch's estate. The presence of some such bird in the neighbourhood was first indicated by the appearance of footmarks on some arable land, quite a month

before the bird itself was seen, and later still, Mr. Gayford observed a very large bird, as he describes it, "towering high in the air like a very big hawk." The mystery was solved, however, on the 30th of August, when a crane was seen by Mr. Gayford himself about a hundred yards from a flock of sheep, and some two hundred yards from the shepherd's "page" who was tending the sheep feeding on a heath of about three hundred acres, with other large heaths and about two hundred acres of arable land adjoining. On that day Mr. Gayford spent several hours on horseback trying to get within shot of it, but learning from the "page" that early in the morning it had been at the sheep-fold and paid little attention to him, he left his gun with the head shepherd, who shot the bird on the following Monday, the 1st of September. Mr. Newby, of Thetford, who stuffed it, informs me it was a male in immature plumage, and weighed ten pounds thirteen ounces. It is now preserved at Wretham Hall, with a white stork shot by Mr. Gayford near the same spot some thirty-five years ago.

HAWFINCH (*Coccothraustes vulgaris*.) The Rev. H. T. Frere informs me that a flock of some fifty hawfinches appeared, in November, in the same garden at Diss where such numbers were shot last winter. The attraction is no doubt the yew-berries, as proved by dissection last year; but as no specimens have been received by our bird stuffers from any other localities, I am inclined to think these birds, notwithstanding their persecution, were all reared in that neighbourhood. One or two pairs are said to have nested in that garden in the summer; they have also bred in several other parts of Norfolk this year.

GREEN SANDPIPER (*Totanus ochropus*.) This species made its appearance in unusual numbers during the months of August and September, both on Breydon and the surrounding marshes, and in most of its usual haunts throughout the county.

MEALY REDPOLE (*Linota canescens*.) This uncertain winter visitant, so scarce last year, was extremely abundant in November and December of this mild season. Many have been netted by the birdcatchers quite close to the city, where they frequent the alder trees by the river.

SWALLOWS AND MARTINS. The late stay of swallows and martins,

in 1873, was remarked in Norfolk, as well as in more southern counties, attributable, I believe, entirely to the mildness of the weather, and a consequent supply of insect food, enabling the old birds to rear their late hatched young ones. These, in most winters, are deserted when the frosts commence, and are left to die in their nests. On the 3rd of November, some twenty or thirty house martins were seen flying about Cromer church, and smaller numbers later in the month. At the same place, also, a few house martins were seen by Mr. Southwell as late as the 5th of December. A sand-martin was seen by Mr. J. H. Gurney, jun. on the river, near Buckenham, on the 21st of November.

SNOW BUNTING (*Plectrophanes nivalis*.) These winter migrants, more commonly abundant in severe than in mild winters, were remarkably numerous throughout the months of November and December, on all parts of our eastern coast. The extreme mildness of the season, and an abundance, everywhere, of food, no doubt detained on our shores such flocks, as in ordinary winters pass on, in advance of snow and frost, to more southern quarters. At Yarmouth, I am informed, they were so plentiful, that at one time the birdcatchers were netting them, for trap shooting, in place of sparrows. At Lowestoft, about the middle of November, I saw a flock of more than a hundred, daily, on the Pakefield cliffs, and many passing inland have been killed on the margins of the broads, as at Ludham, where several were shot from the reed beds, and a few were also netted close to this city.





TRANSACTIONS

OF THE

Norfolk & Norwich

NATURALISTS' SOCIETY;

PRESENTED TO THE MEMBERS FOR

1873—4.

SUPPLEMENT.

NORFOLK LEPIDOPTERA.

NORWICH:

PRINTED BY FLETCHER AND SON,

1874.





TRANSACTIONS OF THE NORFOLK AND NORWICH NATURALISTS'

SOCIETY, 1873—4.



SUPPLEMENT.



FAUNA AND FLORA OF NORFOLK.

PART V. LEPIDOPTERA.

BY CHARLES G. BARRETT.

Read 24th February, 1874. *ref*

FOR four years I have been engaged in collecting, from every reliable source within my reach, information as to the species of Lepidoptera known to be found in the County of Norfolk, and now that my removal from the district deprives me of the opportunity of adding to the list by my own collecting, I think it advisable to lay the results before the Society, especially as by the kindness of the Entomologists of the county they are of a highly satisfactory nature.

As the list is long and the localities numerous, I have not thought it necessary nor even advisable to append the name of the gentleman by whom captured or authenticated, to every species or locality, but to state here the localities for which each Entomologist has made himself responsible, and at the same time to thank them all most heartily for the cordial manner in which they have co-operated with me in the endeavour to make the list complete, and the kindness with which many of them have acceded to my request to be allowed to examine and decide upon what I have considered to be doubtful species. I have unfortunately, however, been compelled to exclude a few species which may *possibly* be found in the county, for want of opportunity of authenticating

them, since it is far better to exclude one or two such species, than to run the risk of including any which do not belong at all to the district. The former error is readily repaired, but the latter by no means so easily.

I am indebted to Lord Walsingham for a list of seven hundred and fifty species collected by him in the parishes of Merton, Stanford, Sturston, Tomston, and Tottington, on the Merton estate, (all of which I have therefore included under the name of "Merton,") and a few at Brandon, Hevingham, and Holkham, as well as thirty local and scarce species taken by his collector, Mr. Eedle, at Horning; to Mr. W. M. Crowfoot, of Beccles, for a list of five hundred species, taken at Aldeby, Broome, Harleston, Ditchingham, Kirby Cane, Gillingham, Geldeston, Ringsfield, Raveningham, Headly, Holt, Barton Turf, and Yarmouth, as well as at Beeles on the Norfolk side; to the Rev. T. H. Marriott, of Wickham Market, Suffolk, for a list of species taken by him at Thetford, Croxton, Narborough, Shadwell, and Hoveton, during his late residence at Croxton; to the Rev. H. Williams, of Croxton, for a list of three hundred species taken in the neighbourhood of Thetford; to the Rev. T. H. Marsh, of Cawston, for a list of five hundred species taken at Cawston, Foulsham, Wood Dalling, Cromer, Booton, Horsford, Blofield, and Diss; to Mr. Frank Norgate, of Sparham Rectory, for upwards of one hundred local and interesting species taken at Sparham, Dilham, Hethersett, Potter Heigham, Booton, Hoekering, Cawston, Stody, Braneaster, Swanton Morley, Whitwell, Heydon, Swannington, Haveringland, Sall, Felthorpe, Ugate, Horning, and Foxley; to Mr. Frederick Bond, of London, for forty local species from Foxley, and a few rarities from Yarmouth; to Messrs. E. L. King, and E. A. Atmore, of Lynn, for over three hundred species collected by them at Lynn, Feltwell, Mintlyn, Wootton, Barton Bendish, Bawsey, Harpley, Castleacre, Wolferton, Rising, Middleton, Roydon, Ringstead, Northwold, Hingham, Clenehwarton, Gaywood, and Leziate; to the Rev. J. Landy Browne, of Norwich, for species taken by him at Norwich, Caistor, Runeton, Dersingham, Hethel, Forncett, St. Faith's, Horning, and Wood Norton; to Mr. A. B. Farn, of London, for three hundred species taken at Horning and Ranworth; to Mr. W. R. Jeffrey, of Saffron Walden, for a few captures at Brandon; to Mr. R. E. Brameld, of Nottingham, for some

taken at Hunstanton; to Mr. F. D. Wheeler, of Norwich and Clare College, Cambridge, for captures by him at Norwich, Stratton Strawless, Buxton, Irstead, Barton Turf, Thurn, Whitesby, Stalham, Horsey, Yarmouth, and Reedham; to the late Mr. P. H. Dicken, formerly of Norwich, for a list of his captures at Norwich, Surlingham, and Yarmouth; and to Mr. J. B. Bridgman, of Norwich, for a few species taken at Norwich and Woodbastwick.

In addition to this I have been kindly allowed to examine and make memoranda of the collections of Messrs. T. E. Gunn, Hickling, Perry, and Amos, of Norwich, of species collected by them, and by Mr. Sayer, formerly of Neatishead, at Norwich, Horsford, Stratton Strawless, Beeston St. Andrew, Hoveton, Neatishead, Irstead, Cringleford, Ketteringham, Kimberly, Costessey, etc., and have myself collected a considerable number of species in and around the City of Norwich, and at Surlingham, Brundall, Yarmouth, Caistor, Ranworth, Horning, Barton Turf, Coltishall, Great Plumstead, Newton St. Faith's, Costessey, Ringland, Easton, Ketteringham, and Brandon.

I have also availed myself of information contained in the following works:—

Haworth's "Lepidoptera Britannica," (1803 to 1829)—which records the captures of the Revs. J. Burrell, T. Skrimshire, and others, in Norfolk.

Curtis's "British Entomology," (1825 to 1840)—which records a few interesting species.

Stephens's "Illustrations of British Entomology," (1827 to 1835)—for captures at Beachamwell, Halvergate, and South Creake.

Wood's "Index Entomologicus," (1833 to 1839.)

C. J. and J. Paget's "History of Yarmouth," (1834)—for species recorded by them at Yarmouth, Caistor, Oby, Thurn, and other places in Norfolk,—the majority of their localities being in Suffolk.

Stainton's "Manual of British Butterflies and Moths," (1857,) and the "Entomologist's Annuals," (1855 to 1873,) edited by the same author.

In these works a very large number of notices of species taken in Norfolk may be found, most of them doubtless authentic, but a few highly apocryphal.

There is also in the "Huddersfield Naturalist," for 1864—5, a list of over seven hundred species, by Mr. T. E. Gunn, of Norwich, recorded as having been taken in Norfolk, and I wish to acknowledge my obligation to Mr. Gunn for the ready and obliging manner in which he has assisted me with information as to the sources from which his list was compiled, and the localities, as far as known, in which the species were taken, and as I am satisfied that he was grossly and intentionally deceived by an interested collector as to the occurrence of at least one hundred and fifty species in the county, I have preferred to ignore this list, and substitute for it such information as he was able to substantiate.

As it is necessary in a list of this kind to have some definite boundary, I have felt compelled to omit a few species which are known to occur at Brandon, and other places on the borders of the county, when they have not actually been taken within its limits.

The arrangement which I have followed is that of M. Guenée, as published in Mr. Henry Doubleday's "Synonymic List of British Lepidoptera," and in many cases in which corrections or alterations in nomenclature have been made, I have appended the synonym in brackets to assist identification.

Several species which have been recorded erroneously in the county are also placed in brackets to distinguish them from those truly forming a part of the list.

A LIST OF THE LEPIDOPTERA KNOWN TO OCCUR
IN NORFOLK.

DIURNI.

- PAPILIO MACHAON. Linn. Found in all the fens of the rivers Yare and Bure, and their tributaries, where its larva feeds on marsh fennel (*Peucedanum palustre*) and other *Umbelliferae*. Its range in this country is gradually becoming more restricted, from the drainage of the fens of Cambridge and Huntingdonshire, and it seems probable that in a few years, it may have ceased to be found in any numbers elsewhere than in our Norfolk fens. Here, however, from the nature and extent of our fens, and their situation along the river courses, and from the strictness with which many of them are preserved, there is reason to hope, that this splendid species may survive till a very distant period.
- LEUCOPHASIA SINAPIS. Linn. Wormegay. Two specimens taken in the Rainbow wood, reported by Mr. Atmore.
- PIERIS CRATEGI. Linn. Curtis in his "British Entomology," states, that "it has been taken in Norfolk." If this is correct it is probably long extinct.
- „ BRASSICÆ. Linn. Abundant everywhere.
- „ RAPÆ. Linn. Abundant everywhere.
- „ NAPI. Linn. Abundant everywhere.
- ANTHOCHARIS CARDAMINES. Linn. Of general occurrence.
- GONEPTERYX RHAMNI. Linn. Of general occurrence.
- COLIAS EDUSA. Fab. Of general occurrence, but irregular in its appearance.
- „ „ Var. HELICE, Hüb. Thetford, Blofield; rare.
- „ HYALE. Linn. Norwich, Horsford, Broome, Aldeby, Merton, Thetford, Halvergate, Potter Heigham. Very uncertain in its appearance; common in 1868.

- ARGYNNIS PAPHIA. Linn. Widely distributed, but not common in this county.
- „ AGLAIA. Linn. Caistor, near Yarmouth, Whitesley; excessively local.
- „ ADIPPE. Fab. Horsford, Stratton Strawless, Cawston, Runcton, Middleton, Tindall wood Ditchingham; local.
- „ LATHONIA. Linn. Very rare; one specimen was taken at Booton by Mr. F. Alderton, and one at Plumstead by Mr. Perry. (This last I have seen.) Mr. King reports one from Beachamwell; Curtis and Stephens both record the species from Halvergate, and Paget, a specimen taken by Capt. Chawner at Caistor rails.
- „ EUPHYROSYNE. Linn. Horsford, Stratton Strawless, Cawston, Hockering, Tindall wood Ditchingham; local.
- „ SELENE. Fab. Horsford, Stratton Strawless, Cawston, Hoveton St. John, Hethel, Wootton; local.
- MELITÆA ARTEMIS. Fab. Norwich, St. Faith's, Cawston, Horning, Aldeby, Beachamwell; in marshy meadows.
- VANESSA C-ALBUM. Linn. Very rare in this county. The Rev. W. F. Welch informed Lord Walsingham that he saw a specimen in his garden at Stradsett, in October, 1858; and took one in the same place in September, 1861; and the Rev. J. W. Colvin met with one, singularly enough, also in the rectory garden at Yarmouth. Mr. Atmore of Lynn, also reports a specimen taken by Mr. W. Pridgeon, jun., at Walpole.
- „ URTICÆ. Linn. Abundant everywhere.
- „ POLYCHLOROS. Linn. Norwich, Ranworth, Gillingham, Merton, Thetford, Sparham, Cawston; formerly common, but scarcer for some years, until the last summer (1873,) when it again appeared commonly.
- ANTIOPA. Linn. Usually a great rarity. Recorded from Gillingham, Marsham, and Horsham; Yarmouth in 1834, by Paget; Sparham, two

specimens, in 1868, by Mr. F. Norgate; and one at Buxton, in 1871, by Mr. F. D. Wheeler. But in August, 1872, it appeared in all parts of the county, and was almost common in its north-east corner. Details are published in the Transactions of this Society for 1872—3.

- VANESSA IO. Linn. Generally common.
- „ ATALANTA. Linn. Generally common.
- „ CARDUI. Linn. Generally common, but irregular in its appearances.
- APATURA IRIS. Linn. Foulsham, Dersingham, Foxley Wood; rare in this county. Mr. Athow tells me that it was found many years ago at Whitlingham.
- ARGE GALATHEA. Linn. Found by Mr. W. M. Crowfoot, at Kirby Cane, but shifting from one place to another each season. Curtis also records it in Norfolk.
- SATYRUS ÆGERIA. Linn. Norwich, Merton, Thetford, Sparham, Ditchingham; not very common in the county.
- „ MEGÆRA. Linn. Abundant everywhere.
- „ SEMELE. Linn. Generally common on heaths and coast sand-hills.
- „ JANIRA. Linn. Abundant everywhere.
- „ TITHONUS. Linn. Abundant everywhere.
- „ HYPERANTHUS. Linn. Plumstead, Stratton Strawless, Hethersett, Merton, Thetford, Beccles, Sparham, Lynn.
- [CHORTOBIUS DAVUS. Fab.] Recorded by Stephens, (Illust. p. 68,) but doubtless in error.
- „ PAMPHILUS. Linn. Abundant everywhere.
- THECLA RUBI. Linn. Norwich, St. Faith's, Swannington, Cawston, Stody, Broome Heath, Merton, Thetford.
- „ QUERCUS. Linn. Merton, Broome, Dersingham, Thetford, Sparham, Barton Bendish, Oby, Ketteringham, Ranworth; among oaks.
- W-ALBUM. Ill. I introduce this species with hesitation. In August, 1872, I met with a number of what I believe to have been *w-album* flying about and settling on the top of a chestnut tree at

Newton St. Faith's, but was unable to obtain a specimen.

- [THECLA SPINL.] Recorded by Stephens, (Illust. p. 78,) thus:—
 "Last July, (1827,) a specimen was captured in Norfolk by Mr. J. Sparshall, F.L.S." When examining the collection of Mr. Sparshall now in the Norwich Museum, some years ago, I found a specimen labelled *spini*, which is certainly not the true *Thecla spini*, Esp. Mr. Doubleday tells me, that he believes it to be a species that was taken plentifully by his late brother in North America, and that it was placed in Mr. Sparshall's collection by mistake. There is no authentic record of the occurrence of this species, or of the true *Thecla spini* in the British Islands.
- „ BETULÆ. Linn. Curtis (Brit. Ent. 264) records this species as having been taken in Norfolk, and the Rev. T. H. Marsh has found it at Sall, on elm. Probably very rare in the county.
- [POLYOMMATUS DISPAR. Haw. HIPPOTHOE. Linn.] Stephens (Illust. 82) gives Norfolk as one of the localities for this species, but there is no reliable record of its occurrence here, and he was probably misinformed.
- „ PHLÆAS. Linn. Common everywhere.
- LYCÆNA ÆGON. Bork. On all heaths.
- „ AGESTIS. SCHIFF. Norwich, Lynn, Hunstanton, Merton, Thetford, Broome Heath; common.
- „ ALEXIS. Hüb. (DORYLAS of Paget) Common everywhere.
- „ CORYDON. Fab. Lynn, Hunstanton, Snettisham, Ringstead Downs; very local.
- „ ACIS. SCHIFF. Under the name of CYMON, Haworth records it (Lep. Brit. 48) as taken by his friend the Rev. J. Burrell, in Norfolk, and Stephens says, "Found in chalky districts in Norfolk." Probably this was an error, but *acis* has disappeared from so many localities in which it was formerly known to be common, that it *may*

have been found also in this county fifty years ago.

LYCÆNA ALSUS. Fab. South Creake, Cromer, Ketteringham (?) scarce.

„ ARGIOLUS. Linn. Cawston, Booton, Thetford, Broome, Gillingham ; not common.

SYRICHTHUS ALVEOLUS. Hüb. Woodton, Tindall wood Ditchingham, Cawston, Horning, Ketteringham ; local.

THANAOS TAGES. Linn. Ditchingham, Ketteringham, Cawston ; also recorded by Haworth and Stephens.

HESPERIA SYLVANUS. Fab. Norwich, St. Faith's, Stratton Strawless, Cawston, Ranworth, Aldeby, Foxley ; common in woods.

„ LINEA. Fab. Norwich, Stratton Strawless, Cawston, Bawsey, Snettisham, Merton, Thetford, Broome.

NOCTURNI.

SMERINTHUS OCELLATUS. Linn. Of general occurrence, the larva frequently found on broad as well as narrow-leaved *Salices*, especially in the fens.

„ POPULI. Linn. Found everywhere, the larva also feeding occasionally on broad-leaved willows.

„ TILIÆ. Linn. Norwich, Raveningham, Merton, Thetford, Lynn, Sparham, Cawston, Horning ; not common.

ACHERONTIA ATROPOS. Linn. Found in all parts of the county, especially in the larva state, but uncertain in its times of appearance. Mr. T. Gunn notes the finding of a handsome brown variety of the larva at Norwich.

SPHINX CONVOLVULI. Linn. Also found occasionally in all parts of the county. Mr. T. E. Gunn records (*Huddersfield Nat.* vol. 1, p. 373,) the discovery of a larva of this species in the county, and describes it as "of a uniform bright green, with brown dots on the back, and oblique yellow stripes on the sides." This larva, unlike that of the previous species, is rarely found with us.

„ LIGUSTRI. Linn. Common everywhere.

- DEILEPHILA GALII. W.V. Very rare. Has been found at Yarmouth, and at Gillingham, near Beccles.
- „ LIVORNICA. Esp. Recorded by Stephens (Illust. vol. 1, p. 127,) as occurring in Norfolk, but without locality.
- CHÆROCAMPA CELERIO. Linn. Also recorded by Stephens, without locality. I know of no recent capture of these two rare species in the county.
- „ PORCELLUS. Linn. Norwich, Merton, Thetford, Broome, Yarmouth, Cawston, Ketteringham, Horning.
- „ ELPENOR. Linn. Of general occurrence. Especially fond of the flowers of *Iris pseud-acorus* (yellow-flag.)
- [„ NERII. Linn.] A specimen of this splendid rarity was obtained at Southtown, by the Rev. J. W. Colvin, of Yarmouth, in August, 1872. Its occurrence for the first time so close to the border of the county seems worthy of being noticed here.
- MACROGLOSSA STELLATARUM. Linn. Of general occurrence, common on the coast sand-hills.
- „ FUCIFORMIS. Linn. Merton, Horsford, Heydon, Cawston, Briston; not common.
- „ BOMBILIFORMIS. Esp. Woodbastwick, Cawston, Horsford; not common.
- SESLIA MYOPÆFORMIS. Bork. I have received specimens of this species from several of the old gardens in the middle of Norwich, where its larva feeds in the bark of the apple trees. It seems not to have been noticed elsewhere in the county.
- „ CULICIFORMIS. Linn. I have seen a specimen in the collection of a working man, which he states was taken by him near Norwich.
- „ ICHNEUMONIFORMIS. W.V. Recorded by Curtis and Stephens as having been taken at South Creake in 1823. No recent captures in the county known, though it has occurred recently at Brandon on the Suffolk side of the river.

- SESIA TIPULIFORMIS.** Linn. Norwich, Yarmouth, Lynn; common among currant bushes in gardens.
- „ **SPECIFORMIS.** W.V. The Rev. T. H. Marsh assures me, that he has taken this rarity near Horsford. Its food plant, the alder, is so abundant that it may reasonably be expected to occur in other parts of the county.
- „ **BEMBECIFORMIS.** Hüb. Taken by Mr. Sayer at Neatishead. Also recorded by Curtis.
- „ **APIFORMIS.** Linn. Norwich, Costessey, Cawston, Martham; rather common on poplars; often mistaken for a hornet.
- ZEUZERA ÆSCULI.** Linn. Norwich, Ketteringham, Whitwell, Lynn, Merton, Thetford, Geldestone, Yarmouth; not common.
- COSSUS LIGNIPERDA.** Fab. Norwich, Merton, Thetford, Geldestone, Yarmouth, Horning, Sparham; probably everywhere. In many places the trunks of the ash, oak, willow, poplar, and other trees are completely riddled with the burrows of the larva of this species, and in some cases these trees bleed copiously, the flowing sap being warmly appreciated by hornets, wasps, and butterflies. The rare *Vanessa antiopa* has been taken at them, and *V. polychloros* and *atalanta* are sometimes seen in numbers.
- HEPIALUS HECTUS.** Linn. Norwich, Ketteringham, Merton, Thetford, Gillingham, Wootton, Oby; rather local.
- „ **LUPULINUS.** Linn. Abundant everywhere.
- „ **SYLVINUS.** Linn. Norwich, St. Faith's, Swannington, Merton, Thetford, Gillingham, Yarmouth; on heaths.
- „ **HUMULI.** Linn. Common everywhere.
- PROCRIS STATICES.** Linn. Brandon. Paget records it at Caistor marrams, but I have no recent notice of it there.
- ZYGÆNA TRIFOLII.** Esp. Near Norwich, Cawston, Ranworth, Horning, Neatishead, Bawsey; local in fens and damp meadows. Paget records it under the name of *LOTI*, var.

- ZYGÆNA LONICERÆ*. Esp. Aldeby (?) Foxley Wood ; also a local species, but not likely to be found in damp situations.
- „ *FILIPENDULÆ*. Linn. Aldeby, Thetford, Cawston, Lynn district ; uncommon and very local in this county, but abundant in most parts of England.
- NOLA CUCULLATELLA*. Linn. Norwich, Merton, Aldeby, Cawston, Horning ; probably everywhere among blackthorn.
- „ *CONFUSALIS*. H-S. [*CRISTULALIS*, Dup. D.L.] Sprowston, Rackheath, Cawston ; not common.
- „ *STRIGULA*. W.V. (?) Said by Paget to be found on the Quay, Yarmouth ; I know of no recent captures there.
- NUDARIA SENEX*. Hüb. Norwich, Surlingham, Horning, Ranworth, Cawston, Merton, Aldeby ; very common in the fens, flying at night in July and August.
- „ *MUNDANA*. Linn. Merton, Aldeby, Yarmouth, Cawston, Horning ; not common.
- CALLIGENIA MINIATA*. Forst. Norwich, St. Faith's, Hockering, Cawston, Foulsham, Wood Norton, Barton Bendish, Aldeby, Merton.
- LITHOSIA MESOMELLA*. Linn. Horsford, Stratton Strawless, Cawston, Foulsham, Lynn, Narborough, Horning, Aldeby ; local.
- „ *MUSCERDA*. Hüb. Ranworth, Horning, Irstead, Brundall ; abundant in the fens of Norfolk. Curtis in his British Entomology records the finding of two specimens floating in a ditch at Horning, by Mr. J. Sparshall. Some years after this the Rev. J. Landy Brown, found it flying commonly in the evening among alders in the same locality, and it has since been taken in plenty by those who have collected in that and the neighbouring fens. It is not known to occur elsewhere in the British Islands.
- „ *AUREOLA*. Hüb. (*UNITA*, Esp.) Norwich, Merton ; scarce.

- LITHOSIA COMPLANULA. Bdv. (LURIDEOLA, Fr.) Common everywhere.
- „ COMPLANATA. Linn. Merton, Thetford, Yarmouth, Cawston, St. Faith's, Horning. At Merton and Brandon a variety of this species is found which approaches closely to *Lithosia molybdeola*, Gn., (*Sericea* Greg.) and in my opinion serves to prove that the latter form is merely a variety of *complanata*.
- „ GRISEOLA. Hüb. Generally common, abundant in the fens.
- „ „ Var. STRAMINEOLA. Dbl. Also of general occurrence, and rather plentiful in the fens. This form was long considered to be a distinct species, and has only just been *proved* to be a variety of *griseola*, both forms having been reared by the Rev. John Hellins, of Exeter, from a batch of eggs laid by a female *stramineola* from Ranworth fen. This form is peculiar to the British Islands.
- „ QUADRA. Linn. Norwich, Horsford, Horning; scarce. Formerly common near Yarmouth, according to Paget.
- „ RUBRICOLLIS. Linn. Of general occurrence, but not very common.
- EUCHELIA JACOBÆ. Linn. Common everywhere.
- EUTHEMONIA RUSSULA. Linn. On all heaths.
- ARCTIA PLANTAGINIS. Linn. Ketteringham; scarce.
- „ CAJA. Linn. Common everywhere.
- „ VILICA. Linn. Norwich, Thetford, Brandon, Broome, Merton.
- SPILOSOMA FULIGINOSA. Linn. Norwich, Merton, Brandon, Horning, Cawston; not common.
- „ MENDICA. Linn. Merton, Sparham, Cawston, Horstead, Norwich, according to Stephens; not common.
- „ LUBRICEPEDA. Linn. Common everywhere.
- „ MENTHASTRI. W.V. Common everywhere.
- „ URTICÆ. Esp. Norwich, Thetford, Surlingham, Horning, Lynn, Gillingham, Barton Turf, in the fens, but scarce.

- LIPARIS CHRYSORRHŒA. Linn. Norwich, Yarmouth, Aldeby; scarce in this county, and differing from its usual habit of being abundant where it occurs.
- „ AURIFLUA. Fab. Abundant everywhere.
- „ SALICIS. Linn. Norwich, Horning, Yarmouth, Gillingham, Thetford; apparently not very common.
- „ DISPAR. Linn. Formerly at Horning and Cawston, but long since extinct. The Rev. T. H. Marsh, says, "Not uncommon at Cawston, in 1861, but not seen since." Curtis's observations in his British Entomology are so interesting, that I think them worth transcribing:—"It is not easy to conceive the delight I experienced when a boy, on finding the locality for the Gipsy Moth. After a long walk I arrived at the extensive marshes of Horning, in Norfolk, having no other guide to the spot than the Myrica gale, and on finding the beds of that shrub, which grows freely there, the gaily coloured caterpillars first caught my sight. They were in every stage of growth, some being as large as swan's quills. I also soon discovered the moths which are so totally different in colour as to make a tyro doubt their being partners. The large loose cocoons were also very visible, and on a diligent search I found bundles of eggs covered with the fine down from the abdomen of the female. With eggs, caterpillars, chrysalides, and moths, I speedily returned, enjoying unmixed delight in my newly gained acquisitions, and looking forward with pleasure to the feeding and rearing my stock the following year."

The Myrica gale still flourishes at Horning, but the "Gipsy" Moths have long disappeared. Whether the females and eggs which have been turned out lately by Entomologists will have any effect in re-establishing the species, remains to be seen. Doubtless Curtis reared his larva,

there is no species more easy to propagate and rear in confinement. The breed has been kept up for many years past in this manner, and there seems to be no prospect of its failing, but why, under such circumstances, the insect at large should have become almost totally extinct in this country is simply inexplicable.

LIPARIS MONACHA. Linn. Merton, Cawston, Foulsham, Horsford, Stratton Strawless; not common.

[ARCTURUS SPARSHALLII. Curt.] Of this insect Curtis writes:—

“Captured by Joseph Sparshall, Esq., in a lane near Horning, early in the morning of the 7th August, 1829. He believes it was resting upon the trunk of an elm tree.” My friend, Mr. Doubleday, of Epping, who was friendly for many years with Mr. Sparshall, tells me that he is under the impression that this specimen was obtained from Mr. Wigham. Nevertheless Curtis’s circumstantial account seems to indicate its actual *capture* in this country, in which case it was undoubtedly imported in the larva or pupa state, since there is no reason whatever to suppose that this species has ever inhabited this country. Boisduval states, that it is American, but there seems reason to believe rather that it is a native of Australia.

ORGYIA PUDIBUNDA. Linn. Of general occurrence.

„ FASCELINA. Linn. The larva of this species is found not uncommonly on hedges to the north of Norwich, but the perfect insect is very seldom taken. Paget records it at Yarmouth.

„ GONOSTIGMA. Linn. Horning and Ranworth fens; rare. Haworth also records it from Norfolk.

„ ANTIQUA. Linn. Abundant everywhere.

DEMAS CORYLI. Linn. Thetford.

TRICHIURA CRATEGI. Linn. Norwich, Cawston; scarce.

PŒCILOCAMPA POPULI. Linn. Norwich, Merton, Gillingham, Cawston, Sparham.

- ERIOGASTER LANESTRIS. Linn. Of general occurrence ; in some seasons the larvæ are very abundant, forming large nests of silk on the hawthorn and black-thorn hedges.
- BOMBYX NEUSTRIA. Linn. Of general occurrence, sometimes common.
- „ RUBI. Linn. Of general occurrence on heaths.
- „ QUERCUS. Linn. Generally common. This and the allied species are seldom taken in the perfect state, but commonly in that of larva.
- ODONESTIS POTATORIA. Linn. Common everywhere ; abundant in the fens.
- [EUTRICHA PINI. Linn.] This species, like *Arcturus sparshallii*, was recorded by Curtis, and on the same authority. He writes :—“ Joseph Sparshall, Esq., took a fine male in the Norfolk and Norwich Hospital, 23rd July, 1809.” If this is correct, it is almost certain that the specimen must have been imported in the pupa state with foreign timber, and this might easily be the case as *Eutricha pini* is common in Germany and other parts of the Continent, but I think it likely that Mr. Sparshall mixed his Foreign and British insects, and thus fell into various errors. *E. pini* is not known as a British insect.
- GASTROPACHA QUERCIFOLIA. Linn. Norwich, Merton, Brandon, Thetford, Aldeby, Ranworth, Sparham, Cawston, Bawsey, near Lynn ; not very common.
- SATURNIA CARPINI. Bork. Norwich, Merton, Aldeby, Ranworth, Horning, Dilham, Cawston. In the fens its larva feeds principally on *Spiræa ulmaria* (meadow-sweet.)

GEOMETRÆ.

- OURAPTERYX SAMBUCATA. Linn. Common everywhere.
- EPIONE VESPERTARIA. Linn. Very rare. One specimen taken at Neatishead, in 1860, by Mr. Sayer, and one at Cawston, by the Rev. T. H. Marsh.

- EPIONE APICIARIA*. W.V. Of general occurrence, plentiful in the fens.
- RUMIA CRATEGATA*. Linn. Abundant everywhere. Mr. T. E. Gunn has a very singular variety—pale buff, with yellow veins—taken at Norwich.
- VENILIA MACULATA*. Linn. Merton, Horning, Haveringland, Cawston; local.
- ANGERONA PRUNARIA*. Linn. Aldeby, Foxley, Foulsham.
- METROCAMPA MARGARITATA*. Linn. Of general occurrence.
- ELLOPIA FASCIARIA*. Linn. Norwich, Stratton Strawless, Merton, Brandon, Mintlyn, Cawston; probably in all fir woods.
- EURYMENE DOLOBRARIA*. Linn. Norwich, Costessey, Merton, Aldeby, Thetford, Foxley, Wootton, Cawston, Neatishead; not common.
- PERICALLIA SYRINGARIA*. Linn. Norwich, Ketteringham, Aldeby, Thetford, Foxley, Lynn district, Cawston, Horsford, Ranworth, Horning; not very common.
- SELENIA ILLUNARIA*. Hüb. Common everywhere.
- „ *LUNARIA*. W.V. Once taken in Norwich by Mr. F. D. Wheeler.
- „ *ILLUSTRARIA*. Hüb. Thetford. One specimen bred by the Rev. H. Williams, of Croxton.
- ODONTOPTERA BIDENTARIA*. Linn. Norwich, Merton, Aldeby, Thetford, Cawston.
- CROCALLIS ELINGUARIA*. Linn. Norwich, Aldeby, Thetford, Horning, Lynn, Cawston.
- ENNOMOS TILIARIA*. Hüb. Norwich, Merton, Thetford, Lynn, Sparham, Ranworth, Neatishead; rather common, especially in the fens.
- „ *FUSCANTARIA*. Haw. Norwich; rare.
- „ *EROSARIA*. W.V. Norwich, Merton, Brandon, Cawston; scarce.
- „ *ANGULARIA*. W.V. Norwich, Merton, Thetford, Cawston; not common.
- HIMERA PENNARIA*. Linn. Norwich, Yarmouth, Merton, Thetford, Cawston.

- PHIGALIA PILOSARIA. W.V. Norwich, Sparham, Cawston, Raveningham; not so common as it usually is in other counties.
- BISTON HIRTARIA. Linn. Norwich, Cawston, Lynn, Raveningham; uncommon.
- AMPHIDASIS PRODROMARIA. W.V. Norwich, Thetford, Lynn, Sall, Cawston, Raveningham; not common.
- „ BETULARIA. Linn. Of general occurrence.
- HEMEROPHILA ABRUPTARIA. Thunb. Norwich, Merton, Thetford, Cawston, Wootton.
- CLEORA LICHENARIA. W.V. Of general occurrence.
- BOARMIA REPANDATA. Linn. Common everywhere.
- „ RHOMBOIDARIA. W.V. Common everywhere.
- TEPHROSIA CREPUSCULARIA. W.V. Horsford, Foulsham; not common.
- „ BIUNDULARIA. Esp. Stratton Strawless, Foulsham; not common.
- „ PUNCTULARIA. W.V. Merton, Gillingham, Mintlyn, Wootton, Foulsham; not common.
- GNOPHOS OBSCURATA. W.V. Merton, Barton, Northwold, Yarmouth.
- PSEUDOTERPNA CYTISARIA. W.V. Common on heaths, and waste places on the coast.
- GEOMETRA PAPILIONARIA. Linn. Norwich, Merton, Gillingham, Thetford, Cawston, Irstead, Ranworth, Surlingham; rather frequent in the fens.
- NEMORIA VIRIDATA. Linn. Four specimens were taken at Horning last summer. The species had not previously been suspected, as far as I know, of being found in the Eastern counties, although the fen districts sufficiently resemble the mosses of Lancashire, in which it is abundant, to render its presence intelligible. Had I not seen the specimens, however, I should have felt doubtful on the subject.
- IODIS VERNARIA. Linn. Recorded by Paget in his Yarmouth list, and probably correctly, but no recent capture seems to be known.

- IODIS LACTEARIA*. Linn. Norwich, St. Faith's, Sparham, Cawston, Gaywood, Merton, Aldeby; probably everywhere.
- PHORODESMA BAJULARIA*. W.V. Merton, Foxley, Foulsham; scarce.
- HEMITHEA THYMIARIA*. Linn. Norwich, Yarmouth, Aldeby, Merton, Thetford, Cawston, Sparham, Horning, probably everywhere.
- EPHYRA PORATA*. Linn. Brandon, Horning; scarce.
- „ *PUNCTARIA*. Linn. Norwich, Merton, Thetford, Horning, Cawston, Mintlyn; apparently not common.
- „ *TRILINEARIA*. Bork. Merton, Stratton Strawless; scarce.
- „ *OMICRONARIA*. W.V. Norwich, Aldeby, Merton, Ketteringham, Sparham, Cawston, Yarmouth; not uncommon.
- „ *PENDULARIA*. Linn. Foulsham, Bawsey near Lynn; scarce.
- HYRIA AURORARIA*. Gn. Ranworth, Horning, Hoveton, Neatishead, Cawston, Aldeby; rather common in the wettest parts of the fens. A most lovely species.
- ASTIENA LUTEATA*. W.V. Norwich, Costessey, Mintlyn, Barton, Cawston.
- „ *CANDIDATA*. W.V. Norwich, Merton, Thetford, Aldeby, Cawston, Horning; not very plentiful.
- „ *SYLVATA*. W.V. Foxley, Foulsham; scarce.
- EUPISTERIA HEPARATA*. W.V. Seems to occur everywhere among alders, and much more commonly than in most counties.
- ACIDALIA RUBRICATA*. W.V. Norwich, Merton, Brandon, Thetford, Cawston, Mintlyn, St. Faith's. This beautiful little species was formerly considered a great rarity, until its head quarters on the "Breck" sand of Norfolk and Suffolk were discovered. It is also found on heaths in other parts of the county, but the specimens are frequently much darker in colour than those of the "Breck" district.
- „ *SCUTULATA*. W.V. Common everywhere.

- ACIDALIA BISETATA. Bork. Common everywhere.
- „ INTERJECTARIA. Bdv. (Dilutaria, Hüb.) Common everywhere.
- „ HOLOSERICATA. Dup. Thetford. I have seen a specimen of this exceedingly local species taken by the Rev. H. Williams. Elsewhere it seems confined to Bristol.
- „ INCANARIA. Hüb. Generally common.
- „ ORNATA. Scop. Merton, Wood Dalling; local and scarce.
- „ PROMUTATA. Gn. Norwich, Yarmouth, Aldeby, Merton, Brandon, Leziate; common where it occurs.
- „ SUBSERICEATA. Haw. Norwich, St. Faith's, Merton, Thetford.
- „ IMMUTATA. Linn. Norwich, Surlingham, Ranworth, Horning, Aldeby, Merton, Brandon, Cawston, Wootton; abundant in all the fens.
- „ REMUTATA. Hüb. Norwich, Merton, Lynn, Horning, Cawston, Coltishall; not so abundant as usually is the case.
- „ IMITARIA. Hüb. Of general occurrence.
- „ EMUTARIA. Hüb. Lynn, Wootton. A rare species, but probably to be found in the salt marshes all along the coast.
- „ AVERSATA. Linn. Common everywhere.
- „ INORNATA. Haw. Merton, Brandon, Cawston (?); very local.
- „ EMARGINATA. Linn. Of general occurrence; common in the fens.
- TIMANDRA AMATARIA. Linn. Of general occurrence, but not common
- CABERA PUSARIA. Linn. Abundant everywhere.
- „ ROTUNDARIA. Haw. A single specimen has occurred at Norwich.
- „ EXANTHEMARIA. Scop. Common everywhere.
- CORYCIA TEMERATA. W.V. Norwich, Ketteringham, Merton, Cawston, Neatishead, Yarmouth; recorded by Paget under the name of *punctata*.
- „ TAMINATA. W.V. Norwich, Merton, Thetford, Cawston, Lynn; not very common.

- MACARIA LITURATA. Linn. Yarmouth, Merton, Thetford, Cawston, Mintlyn, Horsford; probably in all fir woods.
- HALIA WAVARIA. Linn. Common everywhere in gardens.
- STRENIA CLATHRATA. Linn. Norwich, Yarmouth, Aldeby, Merton, Thetford, Sparham, Snettisham; common in clover fields. Richly coloured, and variable in this county.
- PANAGRA PETRARIA. Hüb. Norwich, Costessey, Merton, Thetford, Aldeby, Ranworth; a curious pale variety has been found in the fens.
- NUMERIA PULVERARIA. Linn. Cawston, Foulsham.
- FIDONIA ATOMARIA. Linn. Common on all heaths, and found also in the fens.
- „ PINIARIA. Linn. Merton, Thetford, Lynn district, Felthorpe, Cawston, Horsford; probably in all fir woods.
- ASPILATES STRIGILLARIA. Hüb. Horning; scarce.
- „ CITRARIA. Hüb. Merton, Thetford, Brandon, Hunstanton, Snettisham; and one specimen at Norwich. Common in the "Breck" district. Usually a coast insect.
- ABRAXAS GROSSULARIATA. Linn. Abundant everywhere.
- „ ULMATA. Fab. Ketteringham, Merton, Mintlyn, Lynn walks; very scarce.
- LIGDIA ADUSTATA. W.V. Norwich, Aldeby, Merton, Thetford, Horning, Cawston; common.
- LOMASPILIS MARGINATA. Linn. Generally common.
- HIBERNIA RUPICAPRARIA. W.V. Norwich, Aldeby, Thetford, Sparham, Cawston; probably everywhere.
- „ LEUCOPHEARIA. W.V. Norwich, Merton, Aldeby, Sparham, Cawston; not very common.
- „ AURANTIARIA. Hüb. Norwich, Merton, Thetford, Aldeby, Cawston.
- „ PROGEMMARIA. Hüb. Common everywhere.
- „ DEFOLIARIA. Linn. Norwich, Merton, Aldeby, Sparham, Cawston; probably everywhere.
- ANISOPTERYX ÆSCULARIA. W.V. Common everywhere.
- CHEIMATOBIA BRUMATA. Linn. Everywhere abundant.

- OPORABIA DILUTATA. W.V. Norwich, Merton, near Beccles, Cawston ; probably everywhere.
- „ FILIGRAMMARIA. H.-S. Cawston, Norwich? I am not satisfied that this species has really occurred in the county, as some varieties of *Dilutata* are apt to be mistaken for it.
- LARENTIA DIDYMATA. Linn. Norwich, Horning, Cawston, Merton, near Beccles ; probably everywhere.
- „ MULTISTRIGARIA. Haw. Norwich, Yarmouth, Merton, Thetford, Cawston, Neatishead ; on heaths.
- „ PECTINITARIA. Fuess. Norwich, Horsford, Ranworth, Merton, near Beccles.
- EMMELESIA AFFINITATA. Steph. Merton, Horning, Cawston ; not common.
- „ ALCHEMILLATA. Linn. Norwich, Merton, Thetford, Brandon, Aldeby, Horning, Cawston, Barton Bendish ; not common.
- „ ALBULATA. W.V. Norwich, Merton, Aldeby, Horning, Lynn, Wootton ; probably wherever the Yellow Rattle (*Rhinanthus crista-galli*) grows.
- „ DECOLORATA. Hüb. Norwich, Merton, Thetford, Brandon, Aldeby, Cawston, Horning ; common among *Lychnis vespertina*.
- EUPITHECIA VENOSATA. Fab. Norwich, Merton, Thetford, Cawston, Horsford ; among *Silene inflata*.
- „ CONSIGNATA. Bork. Norwich, Shadwell ; very rare.
- „ LINARIATA. W.V. Norwich, Merton, Thetford, Brandon, Cawston ; among *Linaria vulgaris*.
- „ CENTAUREATA. W.V. Norwich, Merton, Thetford, Aldeby, Brandon, Barton Bendish, Yarmouth.
- „ SUCCENTURIATA. Linn. Norwich, Aldeby, Cawston, Hunstanton ; scarce.
- „ SUBFULVATA. Haw. Norwich, Ketteringham, Aldeby, Merton, Thetford, Lynn, St. Faith's, Ranworth ; rather common.
- „ PYGMÆATA. Hüb. One specimen found flying in the sunshine, on the railway embankment at Lakenham, Norwich.
- „ CASTIGATA. Haw. Norwich, Aldeby, Cawston.

- EUPITHECIA VIRGAUREATA. Dbl. Horning ; scarce.
- „ ALBIPUNCTATA. Haw. Horning ; scarce.
- „ VALERIANATA. Hüb. Norwich, Brundall, Ranworth ;
among *Valeriana* in the fens.
- „ IRRIGUATA. Hüb. Hunstanton ; taken by the Rev. H.
Harpur Crewe.
- „ FRAXINATA. Crewe. Norwich, Horning, Yarmouth ;
among ash.
- „ INDIGATA. Hüb. Horsford, Cawston ; in fir woods.
- „ NANATA. Hüb. Common on heaths.
- „ VULGATA. Haw. Common everywhere.
- „ ABSYNTHIATA. Linn. Aldeby, Cawston, Horning.
- „ MINUTATA. Hüb. Norwich, St. Faith's, Cawston,
Brandon.
- „ ASSIMILATA. Dbl. Norwich, Cawston.
- „ TENUIATA. Hüb. Aldeby, Merton, Thetford, Ranworth,
Horning, Cawston, Hunstanton ; common
about tallows in the fens.
- „ SUBCILIATA. Gn. Gillingham, Thetford, Cawston ;
scarce.
- „ DODONEATA. Gn. Thetford ; rare.
- „ ABBREVIATA. Steph. Norwich, St. Faith's, Cawston,
Aldeby.
- „ EXIGUATA. Hüb. Norwich, Aldeby.
- „ SOBRINATA. Hüb. Norwich, Merton, Thetford, Brandon.
- „ PUMILATA. Hüb. Norwich, Cawston, St. Faith's ;
apparently not common.
- „ CORONATA. Hüb. Aldeby, Horning, Cawston.
- „ RECTANGULATA. Linn. Common everywhere.
- COLLIX SPARSATA. Hüb. Surlingham, Aldeby, Ranworth, Hor-
ning, Barton Turf ; pretty common in the fens,
flying around tallow bushes in the evening.
- LOBOPHORA SEXALATA. Hüb. Norwich, Surlingham, Aldeby,
Geldeston, Foulsham, Horning, Ranworth ; not
common. Found principally about tallows in
the fens.
- „ VIRETATA. Hüb. Geldeston, Ketteringham, Neatishead ;
scarce. Recorded in Norfolk by Stephens.
- THERA VARIATA. W.V. Generally common in fir woods.

- THERA FIRMARIA*. Hüb. Norwich, Horsford, Hevingham,
Cawston, Thetford, Plumstead ; among fir.
- YPSIPETES IMPLUVIATA*. W.V. Of general occurrence.
- „ *ELUTATA*. W.V. Common everywhere.
- MELANTHIA RUBIGINATA*. W.V. Common everywhere.
- „ *OCELLATA*. Linn. Generally common.
- „ *ALBICILLATA*. Linn. Norwich, Aldeby, Ormesby,
Barton Bendish, Horning, Neatishead ; not
common. Recorded in Norfolk by Haworth,
Stephens, and Wood.
- MELANIPPE PROCELLATA*. W.V. Norwich, Aldeby, Cawston ; scarce.
- „ *UNANGULATA*. Haw. Merton, Aldeby, Cawston,
Norwich.
- „ *SUBTRISTATA*. Haw. Common everywhere.
- „ *MONTANATA*. W.V. Of general occurrence.
- „ *GALIATA*. W.V. Horning, Cawston ; scarce.
- „ *FLUCTUATA*. Linn. Common everywhere, excessively so
at Norwich.
- ANTICLEA SINUATA*. W.V. Brandon, Thetford ; scarce.
- „ *RUBIDATA*. W.V. Aldeby, Merton, Thetford, Brandon,
Cawston.
- „ *BADIATA*. W.V. Norwich, Aldeby, Merton, Sparham,
Cawston ; probably common everywhere.
- „ *DERIVATA*. W.V. Norwich, Aldeby ; not common.
- „ *BERBERATA*. W.V. Formerly taken at Beachamwell by
Mr. J. Scales, and recorded by Stephens. The
neighbourhood of Beachamwell seems to have
formerly been prolific in rare insects, but it
does not appear to have been worked since the
time of Mr. Scales.
- COREMIA PROPUGNATA*. W.V. Norwich, Merton, Aldeby,
Cawston, Horning, Ranworth.
- „ *FERRUGATA*. Linn. Common everywhere.
- „ *UNIDENTARIA*. Haw. Norwich, Aldeby, Horning ;
probably everywhere.
- „ *QUADRIFASCIARIA*. Linn. Norwich, Aldeby, Merton,
Cawston, Barton, Wootton ; not common.
Recorded from Norfolk by Haworth and
Stephens.

- CAMPTOGRAMMA BILINEATA. Linn. Abundant everywhere.
- „ FLUVIATA. Hüb. Horning, Foulsham ; very rare.
- PHIBALAPTERYX TERSATA. W.V. Ditchingham, Thetford,
Foulsham ; very local.
- „ LIGNATA. Hüb. Norwich, Brundall, Aldeby, Merton,
Thetford, Brandon, Ranworth, Cromer ; very
common in the fens and marshy meadows.
- „ POLYGRAMMATA. Bork. (?) Recorded by Stephens, but
probably by mistake for *Lignata*, yet, as it is
found in Cambridgeshire, I hesitate to exclude
it from this list.
- SCOTOSIA DUBITATA. Linn. Norwich, Aldeby, Merton, Cawston,
Lynn, Ranworth.
- „ VETULATA. W.V. Aldeby, Thetford, Ranworth, Horning,
Surlingham ; among buckthorn (*Rhamnus
catharticus*) in the fens.
- „ RHAMNATA. W.V. Norwich, Merton, Thetford, Ranworth,
Horning ; in similar situations to the last.
- „ CERTATA. Hüb. Norwich, Thetford, Cawston ; among
barberry (*Berberis*.)
- „ UNDULATA. Linn. Aldeby, Ranworth, Foxley, Barton
Bendish, Merton, Foulsham ; not common.
- CIDARIA PSITTACATA. W.V. Thetford ; scarce.
- „ MIATA. Linn. Norwich, Yarmouth, Aldeby, Buxton,
Cawston ; common.
- „ PICATA. Hüb. Merton, Aldeby, Cawston, Ketteringham.
- „ CORYLATA. Thunb. Of general occurrence.
- „ SAGITTATA. Fab. Norwich, Brundall, Aldeby ; scarce.
Found among meadow-rue (*Thalictrum*) in the
fens of this, and the adjoining counties.
- „ RUSSATA. W.V. Abundant everywhere.
- „ IMMANATA. Haw. Generally common.
- „ SUFFUMATA. W.V. Norwich, Aldeby, Cawston.
- „ SILACEATA. W.V. Norwich, Costessey, Foxley, Aldeby,
Cawston, Foulsham ; not common.
- „ PRUNATA. Linn. Norwich, Merton, Aldeby, Thetford,
Horning, Lynn, Cawston ; not very common.
- „ TESTATA. Linn. Common everywhere, particularly in
the fens.

- CIDARIA POPULATA. Bork. Cawston, Barton Bendish; I long hesitated to include this Northern species in our list, but the sight of an undoubted specimen taken by Mr. Atmore of Lynn, has decided the point.
- „ FULVATA. Forst. Of general occurrence.
- „ PYRALIATA. Bork. Norwich, Aldeby, Horning, Cawston.
- „ DOTATA. Linn. Norwich, Aldeby, Horning, Lynn; recorded at Yarmouth by Paget, under the name of *Spinachiata*. Haw.
- PELURGA COMITATA. Linn. Norwich, Yarmouth, Aldeby, Thetford, Lynn, Cawston, Horning; usually a local or scarce species, but common in Norfolk.
- EUBOLIA CERVINARIA. W.V. Norwich, Yarmouth, Kirby Cane, Thetford, Cawston, Lynn district; common.
- „ MENSURARIA. W.V. Norwich, Gillingham, Merton, Thetford, Ranworth.
- „ PALUMBARIA. W.V. Generally common on heaths.
- „ BIPUNCTARIA. W.V. Horsford (?), Brandon, Merton. This species is almost confined to the chalk downs of the south, and where found it is usually abundant. The occurrence of isolated specimens in this district is therefore very curious. It seems to indicate either that the species has been common upon the chalk of the Eastern Counties and is gradually dying out, or that it is gradually effecting a settlement in the district.
- „ LINEOLATA. W.V. Yarmouth, Thetford, Cromer; very common on the sand-hills (or denes) of the coast, and still lingering in the ancient coast district of the "Breck" sand, although far removed from the sea.
- ANAITIS PLAGIATA. Linn. Common everywhere.
- LITHOSTEGE GRISEATA. W.V. (NIVEARIA, D.L.) Brandon, Thetford, This species seems confined, in this country to the "Breck" district, its larva feeding upon the seeds of *Sisymbrium sophia* and *S. cheiranthoides*, but it does not follow these plants into other districts.

- CHESIAS SPARTIATA. Fab. Norwich, Aldeby, Merton, Thetford ;
among broom (*Spartium scoparium*.)
,, OBLIQUARIA. W.V. Norwich, Thetford ; among broom ;
scarce. Probably at Brandon, where it has
occurred on the Suffolk side of the river.

DREPANULÆ.

- PLATYPTERYX LACERTULA. Hüb. Merton, Northwold, uncommon.
DREPANA FALCULA. W.V. Norwich, Merton, Thetford, Aldeby,
Wootton, Cawston, St. Faith's, Horsford ; pro-
bably everywhere.
,, HAMULA. W.V. Merton, Thetford, Cawston, St. Faith's,
Horsford ; not common.
,, UNGUICULA. Hüb. Merton, Thetford ; among beech ;
very local.
CILIX SPINULA. W.V. Common everywhere.

PSEUDO-BOMBYCES.

- CERURA FURCULA. Linn. Yarmouth, Merton, Thetford, Stratton
Strawless, Hoveton, Irstead, Barton Turf ;
probably not rare on sallows in all the fens,
but seldom taken.
,, BIFIDA. Hüb. Norwich, Thetford, Aldeby, Cawston ;
probably not rare among poplars.
,, VINULA. Linn. Of general occurrence.
STAUROPUS FAGI. Linn. Norwich, Merton, Cawston, Foulsham,
Horsford, Stratton Strawless ; very rare now,
although it appears to have been formerly
much more common. It is said that John
Curtis used to take it even in the Cathedral
Close, and he writes in his British Entomology :
"One of the first insects that I remember to
have taken was a female of this insect. It
was fluttering up palings under some lime trees
near Norwich, in the middle of June, and
more than two centuries back Mouffet said
that the *Staphylinus* caterpillar was common
in Norfolk."

The name "*Staphylinus*" caterpillar was evidently given to the larva of this species from the extreme singularity of its form, which somewhat resembles a lobster, and obtains for the perfect insect the name of the Lobster Moth.

I have seen two specimens taken within the last few years a few miles from Norwich, by Messrs. Hickling and Starling.

PETASIA CASSINEA. Fab. Norwich, Thetford, Cawston; apparently scarce, but from appearing in November it may be overlooked.

PYGÆRA BUCEPHALA. Linn. Common everywhere.

CLOSTERA CURTULA. Linn. Merton, Thetford; rare.

„ *RECLUSA*. W.V. Merton, Thetford, Aldeby, St. Faith's, Ranworth, Barton Turf; probably in all the fens and boggy heaths, the larva feeding between united leaves of dwarf sallow.

PTILODONTIS PALPINA. Linn. Norwich, Geldeston, Merton, Thetford, Irstead, Buxton, Foulsham; probably found sparingly among poplars everywhere.

NOTODONTA CAMELINA. Linn. Norwich, Gillingham, Thetford, Lynn, Cawston; not very common.

„ *CUCULLINA*. W.V. Very rare. One specimen in Norwich, attracted by a female bred by Mr. F. D. Wheeler, and a larva found at Horning by Mr. A. B. Farn.

„ *DICTÆA*. Linn. Norwich, Gillingham, Thetford, Foulsham; among poplars.

„ *DICTÆOIDES*. Esp. Norwich (?), Thetford, Foulsham.

„ *DROMEDARIUS*. Linn. Horning, Cawston, Runham, Gillingham, Thetford; scarce.

„ *ZICZAC*. Linn. Norwich, Runham, Gillingham, Thetford, Cawston, St. Faith's, Horning, Ranworth, Irstead, Whitesley. The commonest species of the genus in Norfolk, and apparently found about sallows in all the fens. It is, however, seldom captured except in the larva state.

- NOTODONTA TREPIDA. Fab. Norwich, Cawston, Dilham; rare.
Recorded at Yarmouth by Paget under the name of *Tremula*.
- „ CHAONIA. W.V. Cawston, Stratton Strawless; rare.
- „ DODONEA. W.V. Norwich, Rackheath, Cawston, Gillingham; rare.
- DILOBA CÆRULEOCEPHALA. Linn. Of general occurrence, sometimes plentiful. I once saw over one hundred on gas lamps at Norwich in one night.

NOCTUÆ.

- THYATIRA DERASA. Linn. Norwich, Aldeby, Merton, Thetford, Ketteringham, Cawston, Foulsham, Ranworth, Thurn; not common.
- „ BATIS. Linn. Norwich, Aldeby, Merton, Ketteringham, Cawston, Foulsham, Horning.
- CYMATOPHORA DUPLARIS. Linn. Norwich, Aldeby, Merton, Foxley, Foulsham, Neatishead, Horning, St. Faith's.
- „ DILUTA. W.V. Merton, Foulsham, Neatishead; apparently not common in this county.
- „ OR. W.V. Foxley, Foulsham, Neatishead; scarce.
- „ OCULARIS. Linn. Norwich, Gillingham, Thetford, Cawston, Foulsham. This beautiful and generally rare species, seems frequent and widely distributed in this county.
- „ FLAVICORNIS. Linn. Only observed at Merton by Lord Walsingham, but from its early occurrence it may possibly be overlooked elsewhere.
- „ RIDENS. Fab. Norwich, Stratton Strawless, Cawston; scarce. Also an early species.
- BRYOPHILA GLANDIFERA. W.V. Lord Walsingham records the capture of a single specimen on the Merton estate. It probably occurs also upon the coast.
- „ PERLA. W.V. Abundant everywhere.
- DIPHThERA ORION. Esp. Recorded at Aldeby by Mr. W. M. Crowfoot. It is not rare in Suffolk, but does

- not appear to penetrate further into this county.
- ACRONYCTA TRIDENS. W.V. Norwich, Aldeby, Merton, Thetford, Lynn, Cawston, Horning, Barton Turf; not rare.
- „ PSI. Linn. Abundant everywhere.
- „ LEFORINA. Linn. Norwich, Aldeby, Thetford, Foxley, Cawston, Foulsham, Horning, Stratton Strawless; recorded at Runham by Paget, under the name of *Bradyporina*.
- „ ACERIS. Linn. Of general occurrence.
- „ MEGACEPHALA. W.V. Norwich, Yarmouth, Aldeby, Thetford, Foxley, Cawston, Horning; sometimes abundant among poplars.
- „ STRIGOSA. Fab. Recorded at Foulsham by the Rev. T. H. Marsh. Stephens writes: "Mr. Haworth possesses a single specimen of this insect, which I believe was taken in Norfolk." The species is rare, but as its head quarters are in Cambridgeshire, it may reasonably be expected to occur in West Norfolk.
- „ ALNI. Linn. Merton, Foxley, Cawston, Foulsham; also recorded in Norfolk by Haworth and Stephens. Generally a great rarity.
- „ LIGUSTRI. W.V. Aldeby, Merton, Thetford, Foxley, Lynn, Cawston, Foulsham; among ash.
- „ RUMICIS, Linn. Aldeby, Merton, Thetford, Cawston, Horning.
- „ MENYANTHEDIS. Esp. Two larvæ were found by Mr. F. D. Wheeler at Hickling and Barton Turf, one of which was reared, and the moth is most unquestionably this species. Had I not seen it I should have felt great doubt of the propriety of including this northern species in the Norfolk List.
- SIMYRA VENOSA. Bork. Ranworth, Horning, Reedham; only in the fens. Also recorded in Norfolk by Haworth and Stephens.
- LEUCANIA CONIGERA. W.V. Generally common.

- LEUCANIA TURCA. Linn. Recorded at Foulsham by the Rev. T. H. Marsh. I have seen no Norfolk specimen.
- „ LITHARGYRIA. Esp. Norwich, Aldeby, Lynn district, Horning, Thurn, Stalham.
- „ OBSOLETA. Hüb. Merton, Cawston, Horning ; scarce.
- „ LITTORALIS. Curt. Yarmouth, Caistor, Horsey ; not rare on the coast sands.
- „ PUDORINA. W.V. Aldeby, Merton, Ketteringham, Cawston, Horning, Ranworth ; probably in all the fens.
- „ COMMA. Linn. Norwich, Aldeby, Merton, Thetford Cawston, Horning ; not very common.
- „ STRAMINEA. Tr. Norwich, Cawston, Ranworth, Horning ; probably in all the fens, among reed (*Arundo Phragmites.*)
- „ IMPURA. Hüb. Abundant everywhere.
- „ PALLENS. Linn. Recorded by Paget under the name of *Rufescens* ; common everywhere.
- „ PHRAGMITIDIS. Hüb. Oby, Aldeby, Merton, Brandon, Lynn district, Horning, Ranworth ; probably in all the Fens.
- MELIANA FLAMMEA. Curt. Merton, Brandon, Barton Turf ; very rare.
- SENTA ULVÆ. Hüb. Norwich, Cawston, Ranworth, Horning ; probably in all the fens, but not commonly.
- TAPINOSTOLA ELYMI. Tr. The first notice of the occurrence of this species in Great Britain was by Mr. G. R. Crotch of Weston-super-Mare, who stated in the Zoologist for September, 1861, that he and Mr Winter had both taken specimens. By some extraordinary error these specimens were understood to have been taken in the Norfolk fens (at Ranworth), and a record to that effect appeared in the Entomologists Annual for 1862, page 108. Knowing that the food-plant of this species—*Elymus arenarius*—was an inhabitant of coast sand hills, and not of the fens, I wrote to Mr. Doubleday, by whom the

correct name of the species had been first obtained, and ascertained from him that Mr. Croteli's specimens were taken, not in the fens, but on the coast, near Yarmouth, and this intelligence was afterwards confirmed by Mr. T. Brown of Cambridge, who kindly directed me to the true locality at Caistor, near Yarmouth. Here I had the pleasure of taking last summer, a good number of specimens, thus clearing up all possible doubt about the original locality. The insect has also been taken at Cleethorpes in Lancashire. It is excessively sluggish, and usually found hidden among the *Elymus* and surrounding Marram grass, (*Ammophila arundinacea*.)

- NONAGRIA DESPECTA. Tr. Aldeby, Merton, Surlingham, Horning, Ranworth, Cawston, Hunstanton; very abundant in the fens. Recorded in Norfolk by Curtis and Stephens.
- „ FULVA. Hüb. Norwich, Aldeby, Merton, St. Faith's, Cawston, Foulsham, Horning; common in fens and damp woods.
- „ HELMANNI. Evers. Yarmouth; one specimen taken by Mr. Farr many years ago.
- „ NEURICA. Hüb. Yarmouth, Aldeby, Merton, Horning, Ranworth; probably in all the fens.
- „ BREVILINEA. Fenn. Horning, Ranworth. Norfolk enjoys the honour of being, as far as I know, the exclusive home of this species. It has not been taken in any other part of the kingdom, nor do I know of any locality for it on the Continent. It was discovered by Mr. Charles Fenn, of Lewisham, who, when on a visit to Ranworth in the beginning of August, 1864, took a single specimen. After a careful comparison with the allied species, it was described by him as a novelty, and a notice of it appears in the Entomologist's Annual for 1865, p. 105. Since that time many specimens have been

taken in the fens by different collectors. It is a distinct and well-marked species, and had probably escaped notice from its exceedingly secret and sluggish habits.

- NONAGRIA CANNÆ. Ochs. Taken at Barton Broad by Mr. F. D. Wheeler, but very scarce.
- „ TYPHÆ. Esp. Norwich, West Caistor, Aldeby, Merton, Horning, Barton Broad; probably in all the fens among *Typha latifolia*.
- „ LUTOSA. Hüb. Norwich, Aldeby, Neatishead, Horning. Paget records it at Yarmouth under the name of *crassicornis*. It is also noticed in the county by Haworth, Stephens, and Wood.
- GORTYNA FLAVAGO. W.V. Norwich, Yarmouth, Merton, Thetford, Cromer, Surlingham.
- HYDRÆCIA NICTITANS. Linn. Norwich, Merton, Hoveton, Horning, Hunstanton.
- „ PETASITIS. Dbl. There is in Mr. Gunn's collection one specimen which was taken by Mr. Sayer at Costessey near Norwich. It seems to be very rare in the county.
- „ MICACEA. Esp. Common everywhere.
- AXYLIA PUTRIS. Linn. Norwich, Aldeby, Thetford, Cawston, Lynn, Horning.
- XYLOPHASIA RUREA. Fab. Norwich, Merton, Aldeby, Cawston; apparently *not* common.
- „ LITHOXYLEA. W.V. Generally distributed.
- „ SUBLUSTRIS. Esp. Yarmouth, Aldeby, Foxley, Cawston; not common. Recorded by Paget under the name of *musicalis*.
- „ POLYODON. Linn. Abundant everywhere.
- „ HEPATICA. Linn. Norwich, Aldeby, Cawston, Hockering.
- „ SCOLOPACINA. Esp. Geldestone, Gillingham, Foxley, Wootton, Cawston, Beeston St. Andrew; scarce.
- DIPTERYGIA PINASTRĪ. Linn. Norwich, Geldestone, Merton, Thetford, Mintlyn, Cawston, Horning; common.
- NEURIA SAPONARIÆ. Esp. Norwich, Geldestone, Thetford, Lynn, Cawston, Horsford, Neatishead, Horning.

- HELIOPHOBUS POPULARIS. Fab. Of general occurrence.
 CHARÆAS GRAMINIS. Linn. Of general occurrence, but not common.
 CERIGO CYTHEREA. Fab. Norwich, Yarmouth, Geldestone, Merton,
 Thetford, Foxley, Cawston, Hunstanton;
 common.
 LUPERINA TESTACEA. W.V. Abundant everywhere.
 „ CESPITIS. W.V. Norwich, Merton; scarce.
 MAMESTRA ABJECTA. Hüb. Yarmouth, Horning; rare.
 „ ANCEPS. Hüb. Norwich, Aldeby, Thetford, Lynn,
 Foulsham, Horning; not scarce.
 „ ALBICOLON. Hüb. Yarmouth, Thetford, Brandon; a
 coast species, but still to be found commonly
 on the ancient coast sands of the "Breck"
 district.
 „ BRASSICÆ. Linn. Abundant everywhere.
 „ PERSICARIÆ. Linn. Common everywhere.
 APAMEA BASILINEA. W.V. Norwich, Kirby Cane, Thetford,
 Cawston.
 „ CONNEXA. Bork. Foxley, Foulsham, Neatishead; a
 very local species.
 „ GEMINA. Hüb. Norwich, Aldeby, Thetford, Cawston;
 not common.
 „ UNANIMIS. Hüb. Norwich, Brundall, Aldeby, Thetford,
 Foxley, Cawston, Ranworth, Horsey; rather
 common in the fens and marshes.
 „ OPHIOGRAMMA. Esp. Norwich, Aldeby, Horning; not
 rare in the fens, probably occurring in all of
 them.
 „ FIBROSA. Hüb. Norwich, Surlingham, Aldeby, Cawston,
 Horning, Ranworth; rather common in the fens.
 „ OCULEA. Linn. Abundant everywhere.
 MIANA STRIGILIS. Linn. Common everywhere.
 „ FASCIUNCULA. Haw. Norwich, Brundall, Yarmouth,
 Aldeby, Thetford, Cawston, Rising, Horning;
 plentiful in some of the fens and wet woods.
 „ LITEROSA. Haw. Norwich, Yarmouth, Aldeby, Thet-
 ford, Foxley, Cawston, Hunstanton, Thurn,
 Horning; common on the coast. Recorded in
 the county by Haworth.

- MIANA FURUNCULA. W.V. Norwich, Aldeby, Merton, Brandon, Thetford, Wootton, Hunstanton, Cawston, Horning; local, but very abundant where found. Recorded at Yarmouth by Paget, under the name of *humeralis*.
- „ ARCUOSA. Haw. Norwich, Thetford, Foulsham; apparently scarce.
- CELENA HAWORTHII. Curt. Bawsey, Merton, Horning, Ranworth; probably in all the fens, but not very common.
- GRAMMESIA TRILINEA. W.V. Norwich, Aldeby, Merton, Thetford, Wootton, Cawston; not as common as in most counties.
- HYDRILLA PALUSTRIS. Hüb. Of this excessively rare species I took a male specimen at a gas lamp in the city of Norwich, in June, 1869. I think there are not more than half-a-dozen other British specimens known.
- CARADRINA MORPHEUS. Hufn. Norwich, Aldeby, Thetford, Cawston, Horning; common.
- „ ALSINES. Bork. Norwich, Aldeby, Foxley, Cawston, Neatishead, Horning: not common.
- „ BLANDA. W.V. Norwich, Aldeby, Foxley, Hunstanton, Cawston, Horning; probably everywhere.
- „ CUBICULARIS. W.V. Common everywhere.
- RUSINA TENEBROSA. Hüb. Norwich, Aldeby, Merton, Cawston.
- AGROTIS VALLIGERA. W.V. Yarmouth, Hunstanton, Thetford, Brandon; abundant on the coast, and not less so on the ancient coast sands of Thetford and Brandon, where it seems to have, with several other species, existed unchanged from the time of the later post-glacial epoch.
- „ PUTA. Hüb. Norwich, Aldeby, Thetford, Hunstanton, Cawston; not common.
- „ SUFFUSA. W.V. Norwich, Yarmouth, Aldeby, Merton, Thetford, Cawston, Ranworth; probably everywhere.
- „ SAUCIA. Hüb. Norwich, Yarmouth, Aldeby, Thetford, Cawston; scarce. Recorded by Paget under the name of *æqua*.

- AGROTIS SEGETUM. W.V. Abundant everywhere. The larvæ of this and the next species sometimes do immense mischief to the turnip crop, by eating holes in the solid roots, and causing them to rot.
- „ EXCLAMATIONIS. Linn. Like the last, only too abundant.
- „ CORTICEA. W.V. Norwich, Merton, Thetford, Cawston, Horning; not rare, very dark varieties occasionally found.
- „ RIPEÆ. Hüb. Caistor near Yarmouth, and probably on the sand-hills along the coast; sometimes rather common. This is usually a rare or excessively local species.
- „ CURSORIA. Bork. Yarmouth, Caistor, Hunstanton; excessively abundant on the coast sands, but apparently not found on the old coast sands of the “Breck” district.
- „ NIGRICANS. Linn. Common everywhere; very variable.
- „ TRITICI. Linn. Norwich, Yarmouth, Brandon, Thetford, Hunstanton, Cawston, Horning; scarce, and dull in colour inland; abundant, and richly coloured on the coast, and also on the isolated sands of the “Breck” district. Recorded by Paget under the name of *pupillata*.
- „ AQUILINA. W.V. Norwich, Brandon, Thetford, Cawston, St. Faith's, Horning; sometimes plentiful.
- „ PORPHYREA. W.V. Very common on all heaths.
- „ PRÆCOX. Linn. Yarmouth, Caistor, Thetford; found on the coast sand-hills, and also rarely on the “Breck” sand.
- „ RAVIDA. W.V. Thetford, Hunstanton; very scarce. Recorded in Norfolk by Haworth and Stephens.
- „ PYROPHILA. W.V. Mr. T. Brown, of Cambridge, assures me that he once took a specimen near Yarmouth.
- TRIPHÆNA JANTHINA. W.V. Of general occurrence.
- „ FIMBRIA. Linn. Norwich, Geldestone, Merton, Thetford, Foxley, Ketteringham, Cawston, Foulsham; not very common.
- „ INTERJECTA. Hüb. Of general occurrence.

- TRIPHENA SUBSEQUA. W.V. Thetford, Brandon, Yarmouth; scarce.
- „ ORBONA. Fab. Common everywhere.
- „ PRONUBA. Linn. Abundant everywhere.
- NOCTUA GLAREOSA. Esp. Aldeby, Thetford, Cawston, Neatishead; not common.
- „ AUGUR. Fab. Aldeby, Thetford, Cawston, Ranworth, Horning.
- „ PLECTA. Linn. Generally common.
- „ C-NIGRUM. Linn. Generally common.
- „ DITRAPEZIUM. Hüb. Foxley; very rare.
- „ TRIANGULUM. Ochs. Norwich, Aldeby, Merton, Thetford, Cawston, Horning; not very common.
- „ RHOMBOIDEA. Tr. Aldeby, Merton, Thetford; scarce.
- „ BRUNNEA. W.V. Aldeby, Merton, Foxley, Cawston, Horning, Neatishead; not very common.
- „ FESTIVA. W.V. Of general occurrence, but not so common as in many counties.
- „ DAHLII. Hüb. Aldeby, Wootton, Horning; scarce.
- „ RUBI. Vieweg. Norwich, Aldeby, Merton, Thetford, Foxley, Cawston, Horning, Ranworth; common in the fens.
- „ UMBROSA. Hüb. Norwich, Aldeby, Merton, Cawston, Hunstanton, Horsford, Horning, Ranworth; common in the fens.
- „ BAJA. W.V. Of general occurrence.
- „ XANTHOGRAPHA. W.V. Abundant everywhere.
- TRACHÆA PINIPERDA. Esp. Norwich, Merton, Thetford, Ketteringham, Heydon, Cawston, Neatishead; not common. Recorded in Norfolk by Curtis and Stephens.
- TÆNIOCAMPA. GOTHICA. Linn. Common everywhere.
- „ RUBRICOUSA. W.V. Norwich, Aldeby, Beachamwell, Sparham, Cawston; not scarce.
- „ INSTABILIS. W.V. Common everywhere.
- „ POPULETI. Fab. Gillingham, Cawston; probably scarce, I have not seen it.
- „ STABILIS. W.V. Abundant everywhere.
- „ GRACILIS. W.V. Norwich, Aldeby, Thetford, Cawston; not scarce in marshy places.

- TÆNIOCAMPA MUNDA. W.V. Aldeby, Thetford, Cawston ; not common.
- „ CRUDA. W.V. Common everywhere. This, with the other species of the genus, is found in the early spring, frequenting the blossoms of *Salix caprea* at night.
- ORTHOZIA SUSPECTA. Hüb. Norwich, Thetford, Cawston ; scarce.
- „ UPSILON. W.V. Generally common among willows.
- „ LOTA. Linn. Norwich, Kirby Cane, Thetford, Cawston ; common.
- „ MACILENTA. Hüb. Norwich, Kirby Cane, Thetford, Cawston ; sometimes rather common.
- ANTHOCELIS RUFINA. Linn. Norwich, Kirby Cane, Thetford, Cawston, Stratton Strawless.
- „ PISTACINA. W.V. Common everywhere.
- „ LUNOSA. Haw. Norwich, Kirby Cane, Thetford, Cawston ; not very common.
- „ LITURA. Linn. Generally common.
- GLEA VACCINII. Linn. Abundant everywhere.
- „ SPADICEA. W.V. Generally common.
- SCOPELOSOMA SATELLITIA. Linn. Generally common.
- XANTHIA CITRAGO. Linn. Norwich, Kirby Cane, Cawston ; local, but sometimes common.
- „ CERAGO. W.V. Of general occurrence.
- „ SILAGO. Hüb. Norwich, Kirby Cane, Merton, Thetford, Cawston ; not very common.
- „ AURAGO. W.V. Norwich, Aldeby, Kirby Cane ; very scarce.
- „ GILVAGO. Esp. Norwich, Merton, Thetford, Croxton ; a very local species.
- „ FERRUGINEA. W.V. Common everywhere.
- CIRRÆDIA XERAMPELINA. Hüb. Norwich, Gillingham, Merton, Thetford, Cawston ; local and scarce. Recorded at Costessey, near Norwich, in 1813, by Curtis ; and Stephens writes, "Four or five only were known before 1827, of which three were taken in Norfolk."
- TETHEA SUBTUSA. W.V. Norwich, Cawston ; scarce.
- „ RETUSA. Linn. Horning, Ranworth ; very scarce.

- COSMIA TRAPEZINA. Linn. Common everywhere.
- „ DIFFINIS. Linn. Gillingham, Thetford, Ketteringham, Kimberley, Lynn, Cawston; rather local, among elm.
- „ AFFINIS. Linn. Norwich, Gillingham, Thetford, Ketteringham, Lynn, Cawston, Neatishead; not common.
- EREMOBIA OCHROLEUCA. W.V. Norwich, Aldeby, Thetford; scarce. Recorded in Norfolk by Stephens.
- DIANTHOCIA CARPOPHAGA. Bork. Norwich, Merton, Thetford, Croxton, Foxley, Cawston, Cromer; rather common in the "Breck" district, among *Silene inflata*.
- „ CAPSINCOLA. W.V. Common everywhere among *Lychnis diurna* and *vespertina*.
- „ CUCUBALI. W.V. Norwich, Aldeby, Thetford, Cawston, Horning, Ranworth; common among *Lychnis flos-cuculi* in the fens.
- „ CONSPERSA. W.V. Aldeby, Geldstone, Thetford, Ketteringham, Horning; scarce.
- HECATERA DYSODEA. W.V. Norwich, Aldeby, Thetford, Cawston; local. Very fond of the blossoms of the common red valerian, (*Centranthus ruber*.)
- „ SERENA. W.V. Of general occurrence.
- POLIA FLAVOCINCTA. Linn. Norwich, Kirby Cane, Thetford, Lynn, Horning; recorded by Paget at Yarmouth.
- EPUNDA VIMINALIS. Fab. Aldeby, Merton, Cawston, Ranworth, Horning; not common.
- MISELIA OXYACANTHÆ. Linn. Common everywhere.
- AGRIOPIS APRILINA. Linn. Generally common among oaks.
- PHLOGOPHORA METICULOSA. Linn. Common everywhere.
- EUPLEXIA LUCIPARA. Linn. Of general occurrence.
- APLECTA HERBIDA. W.V. Cawston, Foulsham, Neatishead; abundant at Foxley: very local. Recorded in Norfolk by Haworth, Stephens, and Wood.
- „ OCCULTA. Linn. Yarmouth, Geldstone, Thetford, Foulsham; scarce.
- „ NEBULOSA. Tr. St. Faith's, Cawston, Foulsham, Horning, Thetford; apparently not very common.

- APLECTA ADVENA. W.V. Aldeby, Thetford, Foxley, Ketteringham, Cawston, Foulsham; rather local. Recorded in Norfolk by Haworth, Curtis, Stephens, and Wood, but under the name of *nitens*.
- HADENA ADUSTA. Esp. Aldeby, Horning; large and abundant at Foxley; elsewhere scarce.
- „ PROTEA. W.V. Norwich, Aldeby, Thetford, Cawston.
- „ DENTINA. W.V. Of general occurrence.
- „ CHENOPODII. W.V. Norwich, Thetford, Brandon, Cawston; common in the "Breck" district.
- „ ATRIPLICIS. Linn. Thetford; scarce.
- „ SUASA. W.V. Norwich, Yarmouth, Aldeby, Thetford, Cawston, Ranworth, Horning; not common. Recorded by Stephens and Wood.
- „ OLERACEA. Linn. Abundant everywhere.
- „ PISI. Linn. Of general occurrence.
- „ THALASSINA. Seh. Norwich, Aldeby, Thetford, Lynn, Cawston; apparently not common.
- „ GENISTÆ. Bork. Thetford, Brandon, Horsford; scarce.
- XYLOCAMPA LITHORIZA. Bork. Norwich, Thetford, Lynn, Cawston, Sparham, Horsford, Coltishall; not common.
- CLOANTHA PERSPICILLARIS. Linn. The capture of a single specimen at Yarmouth was announced in the "Entomologist," 1st series, p. 128, (1841.) I have heard of no subsequent capture, but the insect is excessively rare throughout the country.
- CALOCAMPA VETUSTA. Hüb. Thetford, Cawston; scarce.
- „ EXOLETA. Linn. Norwich, Gillingham, Thetford, Wootton, Cawston, Stratton Strawless. Recorded by Paget at Ormesby and Runham.
- XYLINA RHIZOLITHA. W.V. Norwich, Kirby Cane, Thetford, Cawston; not common.
- CUCULLIA VERBASCI. Linn. Norwich, Aldeby, Merton, Thetford, Lynn, Sparham, Cawston, Horning; common. Very seldom observed in the perfect state, but its larva is exceedingly common on *Verbascum thapsus* and *pulverulentum*.
- „ LYCHNITIS. Ramb. Aldeby. Recorded by Mr. Crowfoot.

CUCULLIA ASTERIS. W.V. Stephens states that it has occurred in Norfolk, but gives no locality, nor do I know of any instance.

„ CHAMOMILLE. W.V. Apparently rare in the county. I know of but one specimen, which was taken at Norwich.

„ UMBRATICA. Linn. Norwich, Yarmouth, Broome, Merton, Thetford, Lynn, Horning; not very common. Recorded by Paget under the name of *lactuce*.

HELIOTHIS MARGINATA. Fab. Caistor near Yarmouth, Thetford, Cromer; scarce. Recorded at Caistor by both Curtis and Paget.

„ DIPSACEA. Linn. Yarmouth, Merton, Thetford, Brandon; very local. According to Paget it was formerly common at Caistor rails.

[ANARTA CORDIGERA. Thunb.] Recorded under the name of *albirena* by Haworth (1803) p. 163, as follows: "Habitat on Norfolk heaths, but very rare. Only one specimen seen, which was sent by the Rev. J. Burrell, F.L.S., F.E.S., an unwearied collector of Norfolk insects." Curtis, in his "British Entomology," says: "Taken in Norfolk by the late Mr. Burrell, and preserved in the cabinet of A. H. Haworth, Esq." "it appears merely a variety of *myrtilli* having the wings fuscous instead of crimson ferruginous."

This disposes of this species entirely, as the specimen in question was clearly a variety of *myrtilli*, *cordigera* being a very different insect, and only found on mountain heaths in the North.

„ MYRTILLI. Linn. Norwich, Thetford, Horsford, Cawston, Uppgate, Wolferton, Neatishead; on heaths.

HELIODES ARBUTI. Fab. Broome, Cawston; not common.

AGROPHILA SULPHURALIS. W.V. Merton, Diddlington, Croxton, Brandon; confined to the sands of the "Breck" district, where it is rather common among

Convolvulus arvensis. Found also in Suffolk and Cambridgeshire, but a great rarity in the rest of the kingdom.

ACONTIA LUCTUOSA. W.V. Merton, Thetford; also confined to the "Breck" district in this county, but not scarce on the chalk of the South of England.

ERASTRIA FUSCULA. W.V. Merton, Foxley, Foulsham, St. Faith's; generally found in fir woods.

BANKIA ARGENTULA. Esp. Curtis, in his "British Entomology," says:—"Taken at the end of June among reeds and rushes in bogs in Norfolk, by Mr. Haworth;" and Wood ("Index Entomologicus") gives a similar account, as also does Westwood in his "British Moths." Mr. Haworth, however, does not mention this in his work, whence I conclude that he had not met with the insect at the time when he wrote, but a MS. note in a copy of his work, which formerly belonged to Mr. N. A. Vigers, reads thus:—"A pair were given to me by Mr. Haworth, which were taken in Norfolk." This is evidently in Mr. Vigers's handwriting, and decidedly confirms Curtis's account. Mr. Stainton, in his "Manual," gives the locality in which Haworth took his specimens—Beachamwell—and this Mr. Doubleday has confirmed, so that I feel no doubt that the insect actually was to be found in Norfolk fifty or sixty years ago. As far as I know nobody has collected at Beachamwell since the time of Messrs. Haworth and Scales, so that it is impossible to say whether this very local species still lingers there, or has—like *Liparis dispar*—totally disappeared. It formerly occurred at Whittlesea Mere, but the only locality in the United Kingdom in which, as far as I know, it is now to be found, is in the bogs of Killarney, in the South West of Ireland.

- HYDRELIA UNCA. Linn. Aldeby, Merton, Cawston, Hoveton, Horning, Ranworth, Surlingham; common in the fens now as in Haworth's time. Though not so scarce as the last species, it is hardly found commonly out of the fens except with *argentula* at Killarney.
- BREPHOS PARTHENIAS. Linn. Thetford, Neatishead; not common.
- „ NOTHA. Hüb. Horsford; rare. I have seen a specimen taken by Mr. Sayer.
- ABROSTOLA URTICÆ. Hüb. Of general occurrence.
- „ TRIPLASIA. Linn. Thetford, Cawston, Horning; not common.
- PLUSIA ORICHALCEA. Hüb. Curtis, in his "British Entomology," states that it was taken at "Hethersett in August, by H. Brown, Esq.," and there is a MS. note to the same effect in the handwriting of Mr. Vigers, in the copy of "Haworth's Lepidoptera Britannica," which formerly belonged to him. I know of no recent capture in the county, and the species is very rare elsewhere.
- „ CHRYSITIS. Linn. Generally common.
- „ FESTUCÆ. Linn. Norwich, Yarmouth, Gillingham, Merton, Ketteringham, Cawston, Horning, Wroxham; rather common in the fens flying about flowers of *Lythrum salicaria*.
- „ IOTA. Linn. Norwich, Yarmouth, Aldeby, Merton, Thetford, Foxley, Lynn, Cawston, Horning; not common.
- „ V-AUREUM. Gn. Norwich, Aldeby, Foxley, Sparham, Cawston; scarce.
- „ GAMMA. Linn. Abundant everywhere.
- GONOPTERA LIBATRIX, Linn. Generally common.
- AMPHIPYRA PYRAMIDEA. Linn. Norwich, Yarmouth, Broome, Merton, Thetford, Ketteringham; sometimes common.
- „ TRAGOPOGONIS. Linn. Generally common.
- MANIA TYPICA. Linn. Common everywhere.
- „ MAURA. Linn. Norwich, Aldeby, Merton, Thetford, Sparham, Horning; common.

- TOXOCAMPA PASTINUM*. Tr. Aldeby, Thetford, Merton, Cawston, Neatishead ; not common.
- CATOCALA FRAXINI*. Linn. A specimen of this rare and magnificent species is recorded by Lord Walsingham as having occurred at Holkham, and the Rev. T. H. Marsh records the capture of one at Cawston. Paget says, "One specimen in a garden by the North gates, (Yarmouth) now in Mr. Sparshall's cabinet." I regret to say, that this specimen does not appear to have come, with the remainder of Mr. Sparshall's collection, into the possession of the Norfolk and Norwich Museum.
- „ *NUPTA*. Linn. Norwich, Yarmouth, Geldestone, Merton, Thetford, Lynn district, Sparham, Neatishead ; sometimes common.
- „ *PROMISSA*. W.V. Foxley, Foulsham ; a splendid species and very local, but sometimes plentiful in its favourite localities. Mr. Vigors in a MS. note in Haworth's Lep. Brit., states that a specimen in his collection was taken by Miss Brown, at Hethersett.
- EUCLIDIA MI*. Linn. Norwich, Aldeby, Merton, Thetford, Cawston, Horsford, Ranworth, Horning, Neatishead, Winterton ; not common.
- „ *GLYPHICA*. Linn. Aldeby, Merton, Cawston, Heydon, Horning, Neatishead ; uncommon.
- PHYTOMETRA ÆNEA*. W.V. Merton, Holt heath, Wootton, Cawston, Horsford ; not common.

DELTOIDES.

- HYPENA PROBOSCIDALIS*. Linn. Abundant everywhere.
- „ *ROSTRALIS*. Linn. Norwich, Aldeby, Thetford, Lynn, Horning ; not very plentiful.
- HYPENODES ALBISTRIGALIS*. Haw. Aldeby, Merton, Ranworth ; scarce.
- „ *COSTESTRIGALIS*. Steph. Merton, Cawston, Horning, Ranworth ; scarce. Stephens in his "Illustrations," states that it was taken at Swaffham by Mr. Haworth.

- RIVULA SERICEALIS. W.V. Norwich, Brooke, Surlingham, Aldeby Merton, Barton Bendish, Ketteringham, Cawston; probably in marshes and damp woods generally.
- HERMINIA BARBALIS. Linn. Foulsham, Cawston, Horning; not common.
- „ TARSIPENNALIS. Tr. Norwich, Aldeby, Thetford, Lynn, Ketteringham, Cawston, Horning; common.
- „ GRISEALIS. W.V. Norwich, Aldeby, Merton, Lynn, Cawston, Neatishead; not very common.
- „ CRIBRALIS. Hüb. Diss, Aldeby, Merton, Horning, Ranworth; only in the fens and marshes.

AVENTIÆ.

- AVENTIA FLEXULA. Fab. Norwich, Chedgrave, Merton, Thetford, Neatishead; scarce.

PYRALIDES.

- PYRALIS FIMBRIALIS. W.V. Merton, Cawston, Horning; scarce.
- „ FARINALIS. Linn. Abundant everywhere, in stables and granaries, its larva feeding on grain and meal.
- „ GLAUCINALIS. Linn. Of general occurrence.
- AGLOSSA PINGUINALIS. Linn. Abundant everywhere in houses and granaries.
- PYRAUSTA PURPURALIS. Linn. Aldeby, Ketteringham, Booton, Cawston, St. Faith's, Horsford, Ranworth.
- HERBULA CESPITALIS. W.V. Norwich, Aldeby, Merton, Thetford, Wootton, Ringland; rather common.
- ACENTROPUS NIVEUS. Oliv. Brandon, Merton, Ranworth; probably on weedy ponds, broads, and rivers generally.
- CATACLYSTA LEMNALIS. Linn. Common everywhere about ditches and streams. Swarming in the fen drains.
- PARAPONYX STRATIOTALIS. Linn. Generally common about the rivers, broads, and drains.
- HYDROCAMPA NYMPHÆALIS. Linn. Common about streams and ditches everywhere.

- HYDROCAMPA STAGNALIS. Don. Also pretty common about rivers and drains.
- BOTYS PANDALIS. Hüb. Merton ; taken by Lord Walsingham.
- „ FLAVALIS. W.V. (?) Stephens in his "Illustrations," says, "Rather abundant at Halvergate, Norfolk." And the Rev. T. H. Marsh records it as rare at Cawston. I have seen no Norfolk specimen, and do not think it a likely species to occur here. It is locally abundant in the Isle of Wight, and some parts of the south coast.
- „ HYALINALIS. Hüb. Merton, Thetford ; a scarce species.
- „ VERTICALIS. W.V. Abundant everywhere among nettles.
- „ LANCEALIS. W.V. Aldeby, Barton Bendish ; very local. Recorded at Beachamwell by Stephens, on Mr. Haworth's authority.
- „ FUSCALIS. W.V. Aldeby, Merton, Ketteringham, Cawston, Ranworth ; rather common.
- „ URTICALIS. Linn. Abundant among nettles everywhere.
- EBULEA CROCEALIS. Tr. Norwich, Gillingham, Thetford, Cawston, Barton, Hunstanton ; among *Inula dysenterica*.
- „ VERBASCALIS. W.V. Near Norwich, Aldeby, Cawston, St. Faith's ; among *Teucrium scorodonia* ; local.
- „ SAMBUCALIS. W.V. Norwich, Yarmouth, Aldeby, Thetford, Lynn, Cawston ; among elder.
- LEMIODES PULVERALIS. Hüb. A single specimen of this rare species has occurred at Ranworth. With the exception of a few specimens taken at Folkstone, and the Isle of Wight, within the last four years, I know of no other British examples.
- PIONEA FORFICALIS. Linn. Abundant everywhere in gardens.
- „ MARGARITALIS. Fab. Recorded at Beachamwell by Stephens, and also by Curtis, but I know of no recent captures. It is, however, found in the Cambridge fens.
- PIONEA STRAMENTALIS. Hüb. Norwich, Aldeby, Merton, Wootton, Cawston, Horsford, Coltishall, Ranworth ; local, but probably found in all fens and marshes.

- SPILODES STICTICALIS*. Linn. Merton, Thetford, Brandon, Beachamwell according to Stephens. Pretty common in the "Breck" sand district, but apparently not found elsewhere in the county, and rare throughout England.
- „ *PALEALIS*. W.V. Recorded in Norfolk by Curtis, Stephens, and Wood, but I know of no recent captures. If it is now an inhabitant of the county, it will probably be upon some part of the coast. It is a very rare species, most of the recent British specimens having been taken near Folkestone, in Kent.
- „ *CINCTALIS*. Tr. Generally common in clover fields.
- SCOPULA LUTEALIS*. Haw. Norwich, Aldeby, Ketteringham, Lynn, Cawston : apparently not common.
- „ *OLIVALIS*. W.V. Common everywhere.
- „ *PRUNALIS*. W.V. Abundant everywhere.
- „ *FERRUGALIS*. Hüb. Norwich, Aldeby, Merton, Cawston, Cromer ; not common.
- STENOPTERYX HYBRIDALIS*. Hüb. Of general occurrence.
- EUDOREA AMBIGUALIS*. Tr. Norwich, Aldeby, Cawston, Lynn ; doubtless everywhere.
- „ *BASISTRIGALIS*. Knaggs. Near Norwich, Aldeby ; not common.
- „ *CEMBRE*. Haw. Norwich, Aldeby, Wootton, Cawston, Hunstanton ; not common.
- „ *DUBITALIS*. Hüb. (*PYRALELLA*, W.V.) Norwich, Aldeby, Roydon, Cawston ; probably everywhere.
- „ *LINEOLA*. Curt. Norwich, among old and lichen-covered bushes of blackthorn and hawthorn ; very local.
- „ *MERCURELLA*. Linn. Norwich, Yarmouth, Horsford ; common.
- „ *CRATEGELLA*. Hüb. Norwich, Cawston ; local.
- „ *RESINEA*. Haw. Norwich, on ash trunks ; very local.
- „ *TRUNCICOLELLA*. Stn. Near Norwich, Horsford, Cawston, on fir trunks ; local.
- „ *COARCTALIS*. Zell. (*ANGUSTEA*, Curt.) Norwich, on mossy walls ; local.
- „ *PALLIDA*. Curt. Norwich, Aldeby, Merton, Ranworth, Horning ; very abundant in the fens.

CRAMBITES.

- PLATYTES CERUSSELLUS. W.V. Merton, Brandon, Wootton ; very local, but abundant where it occurs.
- CRAMBUS ALPINELLUS. Hüb. One specimen at Yarmouth Denes in 1873. A rare species in England, previously only found near Portsmouth.
- „ FALSELLUS. W.V. Brandon, Cawston, Ranworth ; scarce.
- „ PRATELLUS. Linn. Abundant everywhere.
- „ SYLVELLUS. Hüb. (ADIPELLUS, Tr.) Horning and Ranworth ; very local, but not scarce in the fens.
- „ PASCUELLUS. Linn. Abundant everywhere.
- „ ULIGINOSELLUS. Zell. Norwich, Ranworth, Horning, St. Faith's ; very local, but common in the fens.
- „ PINETELLUS. Linn. Norwich, Surlingham, Headley, near Beccles, Merton, Brandon, Cawston ; not very common.
- „ LATISTRIUS. Haw. Norwich, Cawston ; abundant on the Denes near Yarmouth.
- „ PERLELLUS. Scop. Generally common. Recorded in Norfolk by Haworth, under the name of *baccaestria*.
- „ WARRINGTONELLUS. Zell. Brandon, Wootton ; apparently rare. An unexpected species in this county, its home being the mosses and moors of Lancashire and the north.
- „ SELASELLUS. Hüb. Norwich, Surlingham, Gillingham, Cawston, Ranworth, Horning ; local, but common in the fens.
- „ TRISTELLUS. W.V. Abundant everywhere.
- „ FASCELINELLUS. Hüb. (PEDRIOLELLUS, Dup.) Yarmouth. This is the only locality known in the United Kingdom for this handsome Crambus. Its larva feeds under the sand of the Denes, on the roots and stems of *Triticum junceum*, living in a silken tube.
- CRAMBUS INQUINATELLUS. W.V. Generally common.
- „ GENICULEUS. Haw. Norwich, Brandon, Cawston, Horning ; probably everywhere.

- CRAMBUS CULMELLUS. Linn. Abundant everywhere
- „ CHRYSONUCELLUS. Scop. Merton, Thetford, Brandon ;
very local.
- „ HORTUELLUS. Hüb. Abundant everywhere.
- „ PALUDELLUS. Hüb. Ranworth, Horning ; very local,
but probably found in all the fens of the Bure
and its tributaries. It is not known to
occur in any other part of the United Kingdom.
- CHILO PHRAGMITELLUS. Hüb. Norwich, Merton, Cawston, Ket-
teringham, Ranworth, Barton Turf ; probably
in all the fens and marshes.
- SCHENOBIUS FORFICELLUS. Thumb. Norwich, Aldeby, Brandon,
Horning, Ranworth ; probably in weedy ditches
and drains everywhere.
- „ MUCRONELLUS. Scop. Norwich, Cawston, Barton Turf,
Horning, Ranworth ; probably in all the fens,
but otherwise a rare and very local species.
- „ GIGANTELLUS. W.V. Diss, Barton Turf, Horning,
Ranworth ; very local, but probably in all the
fens.
- ANERASTIA LOTELLA. Hüb. Yarmouth, Brandon, on the sand
hills of the coast, and also on the ancient sea
sands of the "Breck" district.
- „ FARRELLA. Curt. The original specimens of this species
were taken by a Mr. Farr, who collected in
Norfolk about thirty years ago. He went to
London about 1844, and afterwards died ; it is
therefore impossible now to ascertain the exact
locality of his specimens, but they appear to
have been taken either near Yarmouth or
Lowestoft. Probably the species is to be
found on the sands of the Norfolk and Suffolk
coast
- ILITHYIA CARNELLA. Linn. Horning ; a single specimen taken by
Mr. Eedle, and now in Lord Walsingham's
collection.
- MYELOPHILA CRIBRELLA. Hüb. Merton, Thetford, Brandon ; very
local. The larva feeding in old stems of
Carduus lanceolatus and *Onopordum acanthium*.

- HOMCEOSOMA NIMBELLA. Dup. Abundant among *Jasione montana* on the Denes at Yarmouth.
- „ SENEACIONIS. Vaughan. Norwich ; apparently scarce.
- „ NEBULELLA. Hüb. Norwich, Merton, Brandon, Horning ; among *Carduus nutans* ; very local.
- „ ELUVIELLA. Gn. Merton, Brandon ; very local.
- NYCTEGRETES ACHATINELLA. Hüb. Not scarce on the Denes near Yarmouth, but exceedingly local, and until last summer supposed to be excessively rare. I have seen a specimen from the coast of Suffolk, and think it probable that the species will be found in suitable localities all along the coast of the Eastern counties. Elsewhere it seems only to have been found at Folkestone in this country.
- EPHESTIA ELUTELLA. Hüb. Norwich ; very abundant in grocers' warehouses, where its larva feeds on currants, figs, &c. Probably in similar situations everywhere.
- „ FICELLA. Dougl. Norwich ; in corn and seed warehouses among oilcake, &c.
- „ SEMIRUFA. Haw. I took a specimen, which is supposed to be of the species intended by Haworth, at Norwich, but am not satisfied about it.
- „ PINGUIS. Haw. Norwich, Cawston, on ash trunks ; not common.
- „ ARTEMESIELLA. Steph. Norwich ; rare.
- CRYPTOBLABES BISTRIGA. Haw. Horning ; rare. Two specimens taken here by Mr. Eadle, are in Lord Walsingham's collection. They seem to be larger than those taken in the south of England. It is also recorded in Norfolk by Haworth. (Lep. Brit. 496.)
- PLODIA INTERPUNCTELLA. Hüb. Norwich ; abundant in corn and seed warehouses, where the larva feeds on the grain, &c., showing a special partiality for malt and locust beans.
- PHYCIS CARBONARIELLA. Fisch. Near Norwich, on heaths ; not common.

- PHYCIS ABIETELLA*. W.V. Norwich, Merton, Cawston, and doubtless Brandon, as it is more common there on the Suffolk side of the river than I ever saw it elsewhere. Usually a rare species.
- „ *ROBORELLA*. W.V. Norwich, Merton, Horsford; not common.
- PEMPELIA PALUMBELLA*. W.V. Norwich, Horsford, St. Faith's, Cawston; probably on all heaths.
- RHODOPHLEA FORMOSA*. Haw. Norwich, Cawston; scarce.
- „ *CONSOCIELLA*. Hüb. Norwich, Merton, Cawston; not common.
- „ *ADVENELLA*. Zinck. Norwich, Cawston; not common.
- „ *MARMOREA*. Haw. Norwich; scarce.
- „ *SUAVELLA*. Zinck. Norwich, Cawston, Horsford; scarce.
- ONCOCERA AHENELLA*. W.V. Merton, Brandon; scarce.
- APHOMIA SOCIELLA*. Linn. Generally common.
- „ *ANELLA*. W.V. Yarmouth. A specimen from this locality has been seen by Mr. F. Bond.
- GALLERIA CEREA*. Linn. Norwich, Thetford, Wootton; scarce.
Recorded in Norfolk by Stephens.
- MELIPHORA ALVEARIELLA*. Gn. Thetford. The Rev. H. Williams tells me that this species is very destructive to the bee-hives in his neighbourhood.

TORTRICES.

- HALIAS PRASINANA*. Linn. Norwich, Merton, Ketteringham, St. Faith's, Horsford, Horning; not scarce.
- „ *QUERCANA*. W.V. Merton, Horsford; scarce.
- „ *CHLORANA*. Linn. Ranworth, Horning, Barton Turf; probably in all the fens. Recorded at Norwich by Curtis and Stephens.
- SARROTHRIPA REVAYANA*. W.V. Merton, Cawston, Horsford; scarce.
- TORTRIX PYRASTRANA*. Hüb. (*PODANA*, Scop.) Common everywhere. Recorded by Paget under the names of *fulvana* and *oporana*.
- „ *XYLOSTEANA*. Linn. Common everywhere.
- „ *SORBIANA*. Hüb. Norwich, Merton, Cawston.

- TORTRIX ROSANA. Linn. Abundant everywhere.
- „ CINNAMOMEANA. Tr. Easton, Cawston; scarce.
- „ HEPARANA. W.V. Common everywhere.
- „ RIBEANA. Hüb. Abundant everywhere.
- „ CORYLANA. Hüb. Norwich, Merton, Cawston, St. Faith's, Horning.
- „ UNIFASCIANA. Dup. Abundant everywhere.
- „ COSTANA. W.V. Norwich, Aldeby, Merton, Brandon, Barton, Ranworth; probably in all the fens; very common.
- „ VIBURNANA. W.V. St. Faith's, on boggy heaths.
- „ ICTERANA. Fröl. Aldeby, Merton, Cromer; local.
- „ VIRIDANA. Linn. Abundant everywhere.
- „ MINISTRANA. Linn. Norwich, Merton, Mintlyn, St. Faith's; not very common.
- „ ADJUNCTANA. Tr. (FORSTERANA, Dup.) Norwich, Merton, Barton; probably everywhere.
- DICHELIA GROTIANA. Fab. Horning; taken by Mr. Eedle. Doubtless at Brandon, as it is not uncommon on the Suffolk side of the river.
- LEPTOGRAMMA LITERANA. Linn. Merton, Cawston; scarce.
- PERONEA SPONSANA. Fab. (FAVILLACEANA, Hüb.) Norwich, Merton; among beech.
- „ MIXTANA. Hüb. Merton, Horsford; on heaths.
- „ SCHALLERIANA. Linn. Merton, Cawston, Wootton, St. Faith's, Ranworth; in fens among sallow.
- „ COMPARANA. Hüb. Ketteringham, Ranworth; not common.
- „ COMARIANA. Zell. (PROTEANA, H.S., POTENTILLANA, Cooke.) Merton, St. Faith's, Ranworth; among *Comarum palustre*, in the fens and marshes.
- „ VARIEGANA. W.V. Common everywhere.
- „ CRISTANA. W.V. Cawston; recorded in Norfolk by Stephens and Wood.
- „ HASTIANA. Linn. Norwich, Merton, Cawston, St. Faith's, Ranworth; rather common, its larva feeding in rolled leaves of different species of *salix*.

- PERONEA FERRUGANA. W.V. Norwich, Merton; not common.
Recorded by Haworth.
- „ TRISTANA. Hüb. (LOGIANA, W.V.) Ranworth.
- „ ASPERSANA. Hüb. Norwich, Surlingham, Merton,
Cawston; probably in all the fens; the larva
feeding on *Spirea ulmaria*.
- „ SHEPHERDANA. Steph. Norwich, Surlingham, Merton,
Ranworth, Horning; probably in all the fens;
its larva feeding in tops of *Spirea ulmaria*,
rather later than that of *aspersana*.
- TERAS CAUDANA. Fab. Merton, Cawston, Horning, Ranworth;
common in the fens.
- „ CONTAMINANA. Hüb. Abundant everywhere among
Hawthorn. Recorded by Paget under the
name of *ciliata*.
- DICTYOPTERYX LÆFLINGIANA. Linn. Norwich, Merton; common.
- „ HOLMIANA. Linn. Generally common in hawthorn
hedges.
- „ BERGMANNIANA. Linn. Common everywhere among
rose bushes.
- „ FORSKALEANA. Linn. Norwich, Merton, Cawston, Bar-
ton Bendish; common among maple.
- ARGYROTOZA CONWAYANA. Fab. Norwich, Merton, Cawston, Cos-
tessey; probably everywhere.
- PTYCHOLOMA LECHEANA. Linn. Merton.
- DITULA SEMIFASCIANA. Haw. Merton, Ranworth, Horning; among
sallow; not common
- PENTHINA PICANA. Fröl. (CORTICANA, Hüb.) Merton, Wootton,
Cawston, Costessey, Horning; not common.
- „ BETULETANA. Haw. Norwich, Merton, Lynn, St.
Faith's, Ranworth; among birch.
- „ PRÆLONGANA. Gn. Merton; scarce.
- „ PRUNIANA. Hüb. Common everywhere.
- „ OCHROLEUCANA. Hüb. Norwich, Ketteringham, Caw-
ston, Horning; scarce.
- „ CYNOSBANA. D.L. (VARIEGANA, Hüb.) Common every-
where.
- „ MARGINANA. Haw. Merton, Cawston, Ranworth, St.
Faith's; common in heaths and fens.

- PENTHINA CARBONANA. Dbl. (FULIGANA, Hüb.) Recorded as occurring in Norfolk by Haworth, Curtis, Stephens, and Wood, but I know of no recent captures. It occurs in the Cambridge fens.
- ANTITHESIA SALICELLA. Linn. Merton ; scarce.
- SPILONOTA OCELLANA. W.V. Norwich, Merton, Rackheath ; probably common everywhere.
- „ LARICIANA. Zell. Norwich, doubtless also at Brandon, where it occurs freely on the Suffolk side of the river.
- „ ACERIANA. Mann. Norwich, Yarmouth ; among poplars.
- „ DEALBANA. Fröl. Norwich, Rackheath, Merton ; probably everywhere in woods.
- „ NEGLECTANA. Dup. Norwich ; among poplar.
- „ AMENANA. Dup. (INCARNATANA, Hüb.) Merton ; rare.
- „ SUFFUSANA. Kollar. (TRIMACULANA, Haw.) Norwich, Merton, Lynn ; common among hawthorn.
- „ ROSÆCOLANA. Dbl. Norwich, Cawston ; among roses, generally in gardens.
- „ ROBORANA. W.V. (CYNOSBANA, Fab.) Norwich, Merton, Cawston ; probably common everywhere.
- PARDIA TRIPUNCTANA. W.V. Norwich, Yarmouth, Merton, Gaywood ; probably everywhere.
- ASPIS UDMANNIANA. Linn. Norwich, Merton, Cawston, Wootton ; among bramble.
- SIDERIA ACHATANA. W.V. Recorded in Norfolk by Stephens, under the name of *marmorana*. Probably correctly, as it is found among hawthorn and sloe in the London district.
- SERICORIS BIFASCIANA. Haw. Norwich ; among fir ; scarce.
- „ FULIGANA. Haw. Recorded in Norfolk by Stephens, but possibly in error for *Penthina fuligana*, or for *Sericoris cespitana*. This species is said to be found among *Fleabane* (*Pulicaria dysenterica*), and may probably yet be found in North Norfolk.
- „ DOUBLEDAYANA. Barrett. Ranworth, Horning ; not scarce. Discovered in these fens two years

ago, and not known to occur elsewhere in the united kingdom.

- SERICORIS CESPITANA. Hüb. Yarmouth, Merton, and doubtless at Brandon, where it is common on the Suffolk side of the river. Wood's figure of *fuligana* which he records in Norfolk seems to represent this species.
- „ CONCHANA. Hüb. Norwich, Surlingham, Merton, Ranworth; common in marshes.
- „ LACUNANA. W.V. Abundant everywhere. A curious variety—smoky black with lustrous lines—is found in the fens and marshes, and has been mistaken for *herbana*, Gn., and a small variety has also been taken for *rurestrana*, Dup.
- „ URTICANA. Hüb. Norwich, Plumstead, Merton; probably everywhere.
- „ MICANA. Hüb. Merton, Horning, Ranworth; in marshes. Recorded in Norfolk by Haworth under the name of *pinetana*, and by Stephens under that of *haworthana*.
- MIXODIA RATZBURGHIANA. Sax. Merton; among fir.
- EUCHROMIA MYGINDANA. W.V. (FLAMMEANA, Fröl.) Cawston (?) Recorded in Norfolk under the name of *fulvipunctana*, by Haworth, Stephens, and Wood.
- „ PURPURANA. Haw. Cawston (?) Recorded also by Stephens and Wood, but I have had no opportunity of identifying either this or the last species.
- ORTHOTENIA ANTIQUANA. Hüb. Cawston (?) Recorded by Stephens and Wood, and also by Haworth under the name of *quadrimaculana*. This also I have not seen.
- „ STRIANA. W.V. Norwich, Yarmouth; common.
- „ ERICETANA. Bent. Near Norwich; scarce.
- ERIOPELSA FRACTIFASCIANA. Haw. Merton; probably also at Brandon, where it has occurred on the Suffolk side. This is one of the chalk insects which seems to be either struggling to obtain a footing in this district or else dying out. It abounds in the chalk downs of the South of England.

- PHITHEOCHROA RUGOSANA. Hüb. Norwich, Merton; among
Bryonia dioica.
- CNEPHASIA LEPIDANA. Curt. St. Faith's; on heaths.
- „ MUSCULANA. Hüb. Norwich, Merton; probably every-
where.
- SCIAPHILA NUBILANA. Hüb. Norwich; among hawthorn.
- „ SUBJECTANA. Gn. Norwich, Merton; doubtless common
everywhere.
- „ VIRGAUREANA. Tr. Norwich, Merton; probably every-
where.
- „ ALTERNANA. W.V. Norwich; not common.
- „ HYBRIDANA. Hüb. Norwich, Merton, Wootton; prob-
ably everywhere.
- SPHALEROPTERA ICTERICANA. Haw. (LONGANA, Haw.) Yar-
mouth; common on the Denes.
- CLEPSIS RUSTICANA. Tr. Merton, Horning, Ranworth; common
in the fens.
- BACTRA LANCEOLANA. Hüb. Norwich, Aldeby, Merton, Cawston;
doubtless everywhere among rushes.
- PHOXOPTERYX SICULANA. Hüb. Cawston, Ranworth; uncommon.
- „ UNGUICANA. Linn. Merton, St. Faith's; scarce.
- „ BIARCUANA. Steph. Merton, Lynn, Wootton, Ran-
worth; scarce.
- „ INORNATANA. H.S. (SUBARCUANA, Wilk.) Merton,
Ranworth; scarce, and very local in the
fens.
- „ PALUDANA. Barrett. Ranworth, Horning; very local,
but not rare. Only recognised as a distinct
species about two years ago, and apparently
confined to the fens.
- „ LUNDANA. Fab. Generally common.
- „ DERASANA. Hüb. Merton; scarce.
- „ DIMINUTANA. Haw. Merton, Ranworth; scarce.
- „ MITTERBACHERIANA. W.V. Merton, Cawston, St. Faith's;
not very common.
- GRAPHOLITA PAYKULLIANA. Fab. (RAMELLA, Linn.) Norwich,
Merton, Cawston; among birch.
- „ NISELLA. Linn. (NISANA, D.L.) Merton, Ranworth;
among willow; local.

- GRAPHOLITA NIGROMACULANA. Haw. Norwich, Cawston; among ragwort; not common.
- „ CAMPOLILIANA. W.V. Merton, St. Faith's; among willow.
- „ MINUTANA. Hüb. Yarmouth; on poplar.
- „ TRIMACULANA. Don. Common everywhere among elm.
- „ PENKLERIANA. W.V. Common among alder.
- „ OBTUSANA. Haw. Merton, Foxley; scarce.
- „ NÆVANA. Hüb. Norwich, Merton, St. Faith's, Horning; probably everywhere among holly.
- PHLEODES TETRAQUETRANA. Haw. Merton, St. Faith's, Ranworth; probably everywhere in woods.
- „ IMMUNDANA. Fisch. Norwich, Merton, St. Faith's, Ranworth; among alder; occasionally common.
- „ CRENANA. Hüb. I have seen a specimen which was said to have been taken near Norwich. It is, however, usually a northern species, and this may be a mistake.
- HYPERMECIA CRUCIANA. Linn. (AUGUSTANA, D.L.) Merton, Cawston, Ranworth; common among willow in the fens.
- BATODES AUGUSTIORANA. Haw. Norwich, Merton; common.
- PÆDISCA BILUNANA. Haw. Norwich, Merton, Cawston, Costessey; among birch.
- „ OPPRESSANA. Tr. Norwich, Ranworth; on poplar trunks; rare.
- „ CORTICANA. W.V. Common everywhere among oaks.
- „ PROFUNDANA. W.V. Merton, Ketteringham, Rackheath, St. Faith's; among oaks. Recorded in Norfolk by Haworth, and apparently, under the name of *sylvana*, by Wood.
- „ OCCULTANA. Dougl. Norwich; among young firs.
- „ SOLANDRIANA. Linn. Norwich, Merton, Ketteringham, Cawston; probably everywhere.
- „ SEMIFUSCANA. Haw. Ranworth, Horning; common among willows.
- „ SORDIDANA. Hüb. Norwich, St. Faith's, Cawston, Ranworth; common among alder.
- HALONOTA BIMACULANA. Don. Merton, Cawston; not common.

- HALONOTA CIRSIANA. Zell. Norwich, Merton, Cawston, Wootton, Ranworth. In the fens a singular variety, or possibly a distinct species, is found with straighter and narrower fore wings than usual.
- „ PFLUGIANA. Haw. (SCUTULANA, D.L.) Norwich, Merton, Cawston; not common.
- „ FGENEANA. Linn. Norwich, Merton, Horning; among mugwort (*Artemisia vulgaris*.) Recorded also by Haworth.
- „ NIGRICOSTANA. Haw. Merton, Ringland; scarce.
- „ TRIGEMINANA. Steph. Norwich, Merton, Cawston, St. Faith's; abundant among ragwort.
- „ TETRAGONANA. Steph. Ketteringham; scarce.
- „ COSTIPUNCTANA. Haw. Recorded in Norfolk by Haworth and Stephens, but no such specimens seem to be now in existence; indeed, I know of but one British example which agrees with Haworth's description, and considerable mystery hangs over the species.
- „ EPHIPPANA. Hüb. (POPULANA, Fab.) Ranworth; among willow.
- OLINDIA ULMANA. Hüb. Brooke, Merton; not common. Recorded by Stephens under the name of *hastiana*.
- SEMASIA SPINIANA. Fisch. Norwich, Merton, St. Faith's, Ranworth; sometimes common flying over hawthorn hedges.
- „ JANTHINANA. Dup. Norwich, Horning; local.
- „ RUFILLANA. Zell. Norwich, Merton; among wild carrot.
- „ WÖBERANA. W.V. Norwich, Yarmouth, Horning, Cawston; probably everywhere among fruit trees.
- COCCYX STROBILELLA. Linn. Merton; among spruce fir.
- „ ARGYRANA. Hüb. Norwich, Merton, Cawston, Rackheath; among oaks.
- „ HYRCINIANA. Usler. (TEDELLA, Linn.) Norwich, Merton, Horstead; doubtless abundant everywhere among spruce fir.
- „ DISTINCTANA. Bent. Taken by Lord Walsingham, at Merton. An extremely scarce species, and only found in one or two other localities.

- COCCYX NANANA. Tr. Norwich, Merton ; among spruce fir.
- HEUSIMENE FIMBRIANA. Steph. Wootton, Cawston ; scarce.
- RETINIA BUOLIANA. W.V. Norwich, Merton, Brandon, Cawston, St. Faith's ; probably everywhere among Scotch fir (*Pinus sylvestris*.)
- „ PINICOLANA. Dbl. Merton, Cawston. Curtis, in his "British Entomology," says, "Bred by Mr. Wigham, of Norwich. from shoots of Scotch fir." I think, however, that he has mistaken *buoliana* for this species.
- „ TURIONANA. Linn. Norwich, Merton ; scarce.
- „ PINIVORANA. Zell. Norwich, Merton, St. Faith's ; not uncommon among Scotch fir.
- CARPOCAPSA SPLENDANA. Hüb. Norwich, Brooke, Merton, Rackheath, Ranworth ; among oak.
- „ POMONELLA. Linn. Everywhere among apple trees, its larva feeding in the apples.
- OPADIA FUNEBRANA. Tr. Norwich ; probably everywhere among plums, in which the larva feeds, although the moth is very rarely seen.
- ENDOPISA NIGRICANA. Fab. (NEBRITANA, D.L.) Norwich, Merton ; doubtless everywhere, its larva feeding in green peas.
- [STIGMONOTA DORSANA. Fab.] Recorded in Norfolk by Stephens, but probably in error, as it is a northern species.
- „ CONIFERANA. Ratze. Near Norwich ; not common.
- „ PERLEPIDANA. Haw. Merton, Cawston ; not common.
- „ INTERNANA. Gn. Norwich, Merton : among furze, (*Ulex europæus*.) very local.
- „ COMPOSANA. Fab. Norwich, Merton, Ranworth ; among clover and trefoils.
- „ REGIANA. Zell. Norwich, Merton, Holt, Cawston ; among sycamore. Recorded by Stephens and Wood.
- „ ROSETICOLANA. Zell. (GERMARANA, D.L.) Norwich, Ringland, St. Faith's ; among wild rose.
- DICRORAMPHA POLITANA. W.V. Norwich, Seething, Merton, Cringleford, St. Faith's ; locally abundant.
- „ SEQUANA. Hüb. Norwich, Merton ; very local.

- DICRORAMPHA PETIVERELLA. Linn. Abundant everywhere.
- „ PLUMBANA. Scop. Norwich, Ringland; probably abundant everywhere.
- „ PLUMBAGANA. Tr. Merton, Brandon; local, but common.
- „ SIMPLICIANA. Haw. Norwich, Merton, St. Faith's; common among *Artemesia vulgaris*.
- „ CONSORTANA. Steph. Merton; scarce.
- PYRODES RHEDIELLA. Linn. Norwich, Merton; among hawthorn.
- CATOPTRIA ALBERSANA. Hüb. Merton; not common.
- „ ULICETANA. Haw. Abundant everywhere among furze.
- „ JULIANA. Curt. Norwich, Merton, Cawston, Horning; among oaks, not common.
- „ MICROGRAMMANA. Gn. Yarmouth Denes; rare.
- „ HYPERICANA. Hüb. Norwich, Merton, St. Faith's, Ranworth; probably everywhere among *Hypericum*.
- „ CANA. Haw. (SCOPOLIANA, D.L.) Norwich, Merton, Brandon; common among thistles.
- „ SCOPOLIANA. Haw. (HOHENWARTHIANA, D.L.) Norwich, Merton; among *Centaurea nigra*.
- „ FULVANA. Steph. Norwich; among *Centaurea scabiosa*. Doubtless also at Brandon, where it abounds on the Suffolk side. Probably in other localities, but overlooked.
- „ EXPALLIDANA. Haw. Norwich, Yarmouth; rare.
- „ CITRANA. Hüb. Norwich, Merton, Brandon; very local. Usually a coast species.
- TRYCHERIS MEDIANA. W.V. (AURANA, Fab.) Taken at Horning by Mr. Eedle.
- CHOREUTES SCINTILLULANA. Hüb. Norwich, Merton; scarce.
- XYLOPODA FABRICIANA. Linn. Abundant everywhere.
- „ PARIANA. Linn. Cawston (?) One specimen *indoors* at Norwich, but I suspect that it emerged from among leaves brought from Surrey.
- LOBESIA RELIQUANA. Hüb. (PERMIXTANA, Hüb. Steph.) Merton, St. Faith's; not common.
- EUPÆCILIA NANA. Haw. Merton, Costessey, Horsford; not very common.

- EUPGECILIA ALBICAPITANA. Cooke. (PALLIDANA, Zell.) Yarmouth Denes ; scarce.
- „ ATRICAPITANA. Steph. Norwich, Merton, Brandon, St. Faith's ; among ragwort.
- „ MACULOSANA. Haw. Norwich ; scarce.
- „ ANGUSTANA. Hüb. (CRUENTANA, Fröl.) Common everywhere, especially on heaths.
- „ UDANA. Gn. Merton, Horning, Ranworth ; scarce in the fens.
- „ GEYERIANA. H.S. Brundall, Ranworth ; rather common in the fens, among *Pedicularis palustris*.
- „ NOTULANA. Zell. Merton, Ranworth, Horning ; in the fens, scarce.
- „ RUPICOLA. Curt. Merton ; scarce.
- „ DEGREYANA. Mc. L. Norwich, Merton, Brandon. This lovely species was discovered in Norfolk by Lord Walsingham, and named after him by Mr. Mc. Lachlan, in 1868. A notice of it may be found in the "Entomologist's Annual," for 1869, p. 91. It has since been taken rather freely at Norwich.
- „ CILIELLA. Hüb. (RUFICILIANA, D.L.) Merton, St. Faith's. All the specimens which are found at St. Faith's bogs, are much more irrorated with dark scales than is the usual form of the insect, and are also generally of very small size. It is possible that they may belong to a distinct species, not yet characterized.
- „ ANTHEMIDANA. Curt. Norwich, Merton, Brandon ; among *Erigeron acre*.
- XANTHOSSETIA ZÆGANA. Linn. Of general occurrence.
- „ HAMANA. Linn. Common everywhere.
- CHROSIS TESSERANA. W.V. Yarmouth, Merton, Brandon, Ringland ; common, but very local.
- ARGYROLEPIA BAUMANNIANA. W.V. Said to have been taken at Ketteringham.
- „ SUB-BAUMANNIANA. Wilk. Norwich, Merton ; very local, but sometimes common in chalk pits.

- ARGYROLEPIA BADIANA. Hüb. Merton, and probably Brandon, as it occurs there on the Suffolk side; not common.
- „ CNICANA. Dbl. Cawston, Ranworth; scarce.
- COCHYLIS SMEATHMANNIANA. Fab. Merton, Cawston; scarce.
- „ STRAMINEA. Haw. Norwich, Merton, Cawston, St. Faith's, Ranworth; common in chalky places.
- APHELIA PRATANA. Hüb. (OSSEANA, Scop.) Horning; local. Recorded in Norfolk by Haworth, and at Thetford Warren, by Curtis.
- TORTRICODES HYEMANA. Hüb. Merton; in oak woods.

TINEINA.

- LEMNATOPHILA PHRYGANELLA. Hüb. Norwich, Merton, Horstead; common.
- DIURNEA FAGELLA. W.V. Norwich, Merton, Sparham; doubtless common everywhere.
- EPIGRAPHIA STEINKELLNERIANA. W.V. Norwich; not common.
- TALEFORIA PSEUDO-BOMBYCELLA. Ochs. Merton, Rackheath, near Norwich; probably in all oak woods.
- PSYCHE BETULINA. Zell. (?) Ranworth, Horning.
- „ ROBORICOLELLA. Br. Merton; probably everywhere. The species of this group are so exceedingly obscure and difficult of identification, that I am uncertain whether we have any more in the county, and even whether these are correctly named.
- SOLENOBIA TRIQUETRELLA. Hüb. Brandon; the larvæ (in triangular cases) are abundant on old palings, but all the specimens reared have been apterous females.
- XYSMATODOMA MELANELLA. Haw. Merton; local.
- OCHSENHEIMERIA BIRDELLA. Curt. Merton.
- „ BISONTELLA. Lienig. Merton; scarce.
- SCARDIA CARPINETELLA. Gn. (PARASITELLA, Hüb.?) Merton, Brandon, Horning; among firs.
- „ GRANELLA. Linn. Norwich, Merton, Wootton; abundant in granaries, its larva feeding in the grain and sometimes doing much mischief.

- SCARDIA CLOACELLA. Haw. Norwich, Merton, Wootton; probably common everywhere.
- „ RURICOLELLA. Stn. Norwich, St. Faith's, Wootton, Ranworth; not scarce.
- „ ARCELLA. Fab. Norwich, Merton, St. Faith's Ranworth; rather common.
- TINEA IMELLA. Hüb. Brandon; a very scarce and local species, found where the fields are manured with furrier's refuse.
- „ FERRUGINELLA. Hüb. Norwich, Brandon; not common.
- „ RUSTICELLA. Hüb. Norwich, Merton; common.
- „ TAPETZELLA. Linn. Norwich, Merton, Yarmouth; doubtless everywhere. A complete pest in warehouses and dwellings, its larva devouring the hair stuffing of saddles, chairs, and sofas, and carpets, furs, and articles of wool and hair generally.
- „ MISELLA. Zell. Norwich; very local.
- „ PELLIONELLA. Linn. Everywhere in houses; its larva feeding in woollen cloth and furs.
- „ FUSCIPUNCTELLA. Haw. Norwich, Lynn; common.
- „ PALLESCENTEELLA. Stn. Norwich; in warehouses.
- „ GANOMELLA. Tr. Norwich, Merton, Wootton, Ranworth; common in woods.
- „ BISELLIELLA. Humm. Norwich, Merton; abundant. A most destructive species, its larva feeding on hair, fur, and feathers, and having a decided taste for preserved birds and animals in museums.
- „ SEMIFULVELLA. Haw. Norwich, Merton; not common.
- LAMPRONIA QUADRIPUNCTA. Fab. Norwich; scarce.
- „ LUZELLA. Hüb. Merton; not common.
- „ PRÆLATELLA. W.V. Merton, Brooke, Ranworth; among wild strawberry.
- „ RUBIELLA. Bjerk. Merton, Ranworth; not common.
- INCURVARIA MASCULELLA. W.V. Norwich, Merton; probably everywhere about hawthorn.
- MICROPTERYX CALTHELLA. Linn. Merton.
- „ ARUNCELLA. Scop. Brooke woods; rather common.

- MICROPTERYX SEPELLA. Fab. Norwich, Merton ; on flowers of
Veronica chamaedrys.
- „ MANSUETELLA. Zell. Merton, Ranworth ; scarce.
- „ THUNBERGELLA. Fab. Merton.
- „ PURPURELLA. Steph. Merton ; among birch.
- „ SEMIPURPURELLA. Steph. Merton ; among birch.
- „ UNIMACULELLA. Zell. Merton ; among birch.
- „ SPARMANELLA. Bosc. Merton ; among birch.
- „ SUBPURPURELLA. Haw. Norwich, Merton, St. Faith's ;
abundant among oaks.
- NEMOPHORA SWAMMERDAMELLA. Linn. Norwich, Merton.
- „ SCHWARZIELLA. Zell. Norwich, Merton, Castleacre ;
abundant.
- „ METAXELLA. Hüb. Norwich, Merton, Ranworth ; com-
mon among alder in the fens.
- ADELA FIBULELLA. W.V. Norwich, Merton ; on flowers of
Veronica chamaedrys.
- „ DE-GEERELLA. Linn. Merton, Brooke ; common in woods.
- „ VIRIDELLA. Linn. Norwich, Merton, Wootton, Barton,
St. Faith's ; common about oaks.
- NEMOTOIS SCABIOSELLA. Scop. Norwich ; among *Scabiosa colum-
baria*, very local.
- „ MINIMELLA. Zell. Merton, Ranworth ; not common.
- SWAMMERDAMIA COMPTELLA. Hüb. Norwich, Merton, Wootton ;
common among blackthorn.
- „ CÆSIELLA. Hüb. Norwich, Merton ; among blackthorn.
- „ GRISEOCAPITELLA. Stn. Norwich ; among birch.
- „ PYRELLA. Vill. Norwich, Merton, Wootton ; abundant
among hawthorn.
- YPONOMEUTA PLUMBELLA. W.V. Norwich, Surlingham, Merton ;
among *Euonymus europæus*.
- „ PADELLA. Linn. Norwich, Yarmouth, Merton ; prob-
ably abundant everywhere among hawthorn.
- „ COGNATELLA. Hüb. Norwich, Surlingham, Merton,
Hunstanton ; abundant among *Euonymus*.
- „ EVONYMELLA. Linn. Sprowston, Merton ; among *Prunus
padus*.
- ANESYCHIA FUNERELLA. Fab. Taken by Lord Walsingham at
Brandon ; a very local species.

- PRAYS CURTISELLA. Don. Norwich, Merton ; among ash.
- PLUTELLA XYLOSTELLA. Linn. Norwich, Merton ; probably abundant everywhere among cruciferous plants.
- „ PORRECTELLA. Linn. Merton ; local.
- CEROSTOMA SEQUELLA. Linn. Merton.
- „ VITTELLA. Linn. Norwich, Merton ; among elm.
- „ RADIATELLA. Don. Common everywhere, recorded by Paget under the name of *variellus*.
- „ COSTELLA. Fab. Merton.
- YPSOLOPHUS SYLVELLUS. Linn. Norwich, Merton, St. Faith's ; among oak, not common.
- „ ALPELLUS. W.V. Merton ; among oak.
- HARPIPTERYX SCABRELLA. Linn. Norwich, St. Faith's ; among crab-apple.
- „ NEMORELLA. Linn. Merton ; among honeysuckle.
- „ HARPELLA. W.V. Generally common among honeysuckle.
- PTEROXIA CAUDELLA. Linn. Norwich ; among *Euonymus europæus* ; scarce.
- ORTHOTELIA SPARGANIELLA. Thunb. Norwich, Merton, Hunstanton, Ranworth, Horning ; very common in the fens among *Sparganium*.
- ENICOSTOMA LOBELLA. W.V. Norwich ; among sloe.
- PHIBALOCERA QUERCANA. Fab. Norwich, Merton, Hunstanton ; among oak.
- EXERÆTIA ALLISELLA. Stn. Mr. Stainton tells me that he believes that this very local species was taken on the coast of Norfolk by the late Mr. Wm. Wing. It feeds on *Artemisia vulgaris*.
- DEPRESSARIA COSTOSA. Haw. Norwich, Merton, Brandon ; common among furze.
- „ LITURELLA. W.V. Norwich, Yarmouth, Merton ; among *Centaurea*.
- „ UMBELLANA. Steph. Norwich, Merton, Wootton ; among furze.
- „ ASSIMILELLA. Tr. Merton, Brandon ; among broom.
- „ ATOMELLA. W.V. Norwich, Yarmouth, Merton, Brandon ; among broom.
- „ ARENELLA. W.V. Norwich, Merton ; common.
- „ PROPINQUELLA. Tr. Norwich, Merton, Ranworth.

- DEPRESSARIA SUBPROPINQUELLA. Stn. Norwich, Merton.
- „ RHODOCHRELLA. H.S. Norwich, Merton; scarce.
- „ ALSTRÖMERICIANA. Linn. Norwich, Merton, Ranworth;
abundant among *Conium maculatum*.
- „ VACCINELLA. Hüb. Norwich, Merton, Ranworth.
- „ HYPERICELLA. Hüb. Merton; among *Hypericum*.
- „ CONTERMINELLA. Zell. Norwich, Surlingham, Merton,
Ranworth; common among sallows in the fens.
- „ ANGELICELLA. Hüb. Merton, Surlingham, Ranworth;
common among *Angelica sylvestris* in the fens.
- „ OCELLANA. Fab. Merton, Ranworth; among sallow.
- „ YEATIANA. Fab. Merton, Brandon, Ranworth; common
in the fens.
- „ APPLANA. Fab. Abundant everywhere.
- „ CILIELLA. Stn. Merton, Ranworth; not common.
- „ GRANULOSELLA. Stn. Norwich, Merton, Brandon; among
Anthriscus vulgaris; very local.
- „ ALBIPUNCTELLA. Hüb. Norwich, Merton; not common.
- „ PULCHERRIMELLA. Stn. Norwich; among *Bunium
flexuosum*; scarce.
- „ WEIRELLA. Stn. Norwich, Merton, Brandon.
- „ CHEROPHYLLI. Zell. Norwich, Merton; common.
- „ ULTIMELLA. Stn. Norwich, Ranworth; common in
the fens.
- „ BADIELLA. Hüb. Norwich, Yarmouth, Cromer;
recorded by Haworth in Norfolk.
- „ HERACLIANA. De Geer. Norwich, Yarmouth, Merton,
Thetford.
- PSORICOPTERA GIBBOSELLA. Zell. Merton; scarce.
- GELECHIA CINEREA. Linn. Norwich, Merton; not common.
- „ RUFESCENS. Haw. Norwich, Surlingham, Merton, Ran-
worth; common in the fens.
- „ GERRONELLA. Zell. Norwich, Surlingham, Merton,
Ranworth; common in the fens.
- „ VELOCELLA. Fisch. Near Norwich, Yarmouth; common.
- „ ERICETELLA. Hüb. Norwich, Merton, St. Faith's;
common on heaths.
- „ MULINELLA. Fisch. Norwich, Merton; common among
furze.

- GELECHIA PALUSTRELLA. Dougl. Ranworth, Horning; rare.
- „ SORORCULELLA. Hüb. Merton, Ranworth; among willow.
- „ MUSCOSELLA. Zell. Ranworth; rare.
- „ ALACELLA. Dup. Merton; very rare.
- „ DIFFINIS. Haw. Yarmouth, Merton, Brandon; common.
- „ TERRELLA. W.V. Abundant everywhere.
- „ DESERTELLA. Stn. Yarmouth, Brandon; abundant on coast sandhills, and also on the sands of the "Breck" district.
- „ ACUMINATELLA. Stn. Norwich, Merton; not common.
- „ ARTEMESIELLA. Tr. Merton.
- „ ARUNDINETELLA. Zell. Merton; rare.
- „ SENECTELLA. Zell. Norwich; common in lanes.
- „ MUNDELLA. Dougl. Yarmouth; on the sands.
- „ UMBROSELLA. Zell. Yarmouth; on the sands.
- „ AFFINIS. Haw. Norwich, Brandon; common.
- „ DOMESTICA. Haw. Norwich, Wootton; common.
- „ RHOMBELLA. Hüb. Norwich, among crab; scarce.
- „ PROXIMELLA. Hüb. Norwich, Merton, Ranworth; common among birch and alder.
- „ NOTATELLA. Hüb. Norwich, Merton, Ranworth.
- „ VULGELLA. Hüb. Norwich, Merton; common among hawthorn.
- „ LUCULELLA. Hüb. Merton; among oak.
- „ FUGITIVELLA. Zell. Norwich, Merton; not scarce.
- „ DISTINCTELLA. Zell. Norwich, Yarmouth, Brandon; rather common on the coast and "Breck" sands.
- „ MACULEA. Haw. Norwich; not common.
- „ TRICOLERELLA. Haw. Norwich; among *Stellaria holostea*.
- „ FRATERNELLA. Dougl. Merton, Brandon; its larva feeding in shoots of *Cerastium arvense*.
- „ MACULIFERELLA. Mann. Norwich; very local, but common among *Cerastium semidecandrum*.
- „ MARMOREA. Haw. Yarmouth, Merton, Brandon; very abundant on the coast, and also on the "Breck" sands.
- „ LEUCATELLA. Linn. Norwich; rare.
- „ MOUFFETELLA. W.V. Merton; among honeysuckle.

- GELECHIA DODECELLA. Linn. Near Norwich, Merton, Brandon ;
 common among fir trees.
- „ TENEBRELLA. Hüb. Norwich, Brandon, St. Faith's.
- „ TENEBROSELLA. Zell. Norwich ; scarce.
- „ LIGULELLA. Zell. Norwich, Merton, Brandon, Ran-
 worth ; among *Lotus major* in the fens.
- „ TÆNIOLELLA. Tr. Cringleford.
- „ ANTHYLLIDELLA. Hüb. Norwich, Merton ; common.
- „ ATRELLA. Haw. Surlingham, Ranworth ; among *Hyper-
 icum* in the fens.
- „ SUFFUSELLA. Dougl. Ranworth ; rare.
- „ CEREALELLA. Oliv. Norwich ; rare.
- „ LATHYRI. Stn. Merton ; among *Lathyrus palustris*.
- „ GEMMELLA. Linn. Near Norwich, St. Faith's ; not
 common.
- „ NÆVIFERELLA. Zell. Norwich, Merton ; common among
Chenopodium.
- „ HERMANNELLA. Fab. Wootton ; very local.
- „ PICTELLA. Zell. Yarmouth, Brandon ; common on the
 coast and on the "Breck" sands.
- „ SUBDECURTELLA. Stn. Ranworth ; among *Lythrum
 salicaria* ; rare.
- „ ERICINELLA. Zell. Near Norwich, Merton, St. Faith's ;
 common on heaths.
- „ OSSEELLA. Stn. Norwich ; rare.
- PARASIA METZNERIELLA. Dougl. Merton.
- CLEODORA CYTISELLA. Curt. Merton, Easton ; scarce.
- CHELARIA CONSCRIPTELLA. Hüb. Merton.
- ANARSIA SPARTIELLA. Schr. Norwich, Yarmouth, Merton, Ring-
 land ; among furze.
- NOTHRIS VERBASCELLA. W.V. Norwich ; common among *Ver-
 bascum pulverulentum* ; not known to occur in
 any other part of the united kingdom.
- SOPHRONIA PARENTHESSELLA. Linn. Near Norwich, Merton,
 Cringleford ; very local.
- HARPELLA GEOFFRELLA. Linn. Norwich ; abundant.
- DASYCERA SULPHURELLA. Fab. Abundant everywhere.
- ŒCOPHORA MINUTELLA. Linn. Norwich ; common. Recorded
 in Norfolk by Haworth.

- CYCOPHORA FLAVIMACULELLA*. Stn. Merton, Ranworth ; among
Angelica sylvestris.
- „ *TRISIGNELLA*. Zell. Norwich ; not common.
- „ *LUNARIS*. Haw. Norwich, Cringleford ; scarce.
- „ *TINCTELLA*. Tr. Norwich, Merton ; not common.
- „ *FUSCO-AURELLA*. Haw. Merton.
- „ *FLAVIFRONTELLA*. Hüb. Norwich ; very local.
- „ *FUSCESCENS*. Haw. Norwich, Merton, St. Faith's ;
 common.
- „ *PSEUDO-SPRETELLA*. Stn. Abundant everywhere in
 houses, its larva feeding on all sorts of dried
 animal and vegetable substances.
- ENDROSIS FENESTRELLA*. Scop. Abundant everywhere in houses.
 Recorded by Paget as *sarcitella*.
- BUTALIS GRANDIPENNIS*. Haw. Norwich, Horning ; common
 among furze.
- „ *INCONGRUELLA*. Stn. Horsford ; on heaths.
- PANCALIA LEUWENHÖCKELLA*. Linn. Merton ; scarce.
- ACROLEPIA AUTUMNITELLA*. Curt. Merton, Ranworth ; among
Solanum dulcamara.
- GLYPHIPTERYX FUSCOVIRIDELLA*. Haw. Norwich, Merton, Woot-
 ton, St. Faith's ; abundant.
- „ *THRASONELLA*. Scop. Norwich, Merton, Brandon ;
 abundant among rushes.
- „ *CLADIELLA*. Stn. Norwich, Merton, Brandon, Ranworth,
 Barton Turf ; common among rushes. Prob-
 ably a variety of the preceding, but found only
 in the fens.
- „ *EQUITELLA*. Scop. Norwich ; common among *Sedum*
acre.
- „ *SCHENICOLELLA*. Boyd. Merton, Ranworth, Barton
 Turf ; common in the fens, but not known to
 occur elsewhere, except at the Land's End,
 Cornwall.
- „ *FISCHERIELLA*. Zell. Norwich, Merton ; common.
- ÆCHIMIA DENTELLA*. Stn. Norwich, Easton ; local, but not
 scarce.
- PERITIA OBSCURIPUNCTELLA*. Stn. Merton.
- TINAGMA SERICEELLA*. Haw. Merton.

- TINAGMA RESPLENDELLA. Dougl. Merton, Ranworth ; scarce.
- DOUGLASIA OCNEROSTOMELLA. Stn. Merton, Brandon ; among
Echium vulgare, very local.
- ARGYRESTHIA EPHIPPELLA. Fab. Merton ; local.
- „ NITIDELLA. Fab. Abundant among hawthorn every-
where.
- „ SEMITESTACELLA. Curt. Norwich, Ketteringham ;
among beech.
- „ ALBISTRIA. Haw. Norwich ; among blackthorn.
- „ CONJUGELLA. Zell. Costessey, St. Faith's ; among
mountain ash.
- „ SEMFUSCA. Haw. Norwich, St. Faith's ; common
among hawthorn.
- „ MENDICA. Haw. Norwich, Merton ; common among
blackthorn.
- „ GLAUCINELLA. Zell. Merton, Ringland ; among oak.
- „ RETINELLA. Zell. Merton, Brooke, Costessey ; among
birch.
- „ DILECTELLA. Zell. Merton ; among juniper.
- „ CURVELLA. Linn. Norwich ; among apple.
- „ PYGMÆELLA. Hüb. Ranworth, Horning ; abundant
among willow.
- „ GEDARTELLA. Linn. Norwich, Brooke, Merton ; among
alder and birch.
- „ BROCKEELLA. Hüb. Merton, Yarmouth, Costessey ;
among alder. Apparently recorded by Paget
under the name of *I. w-ella*.
- „ ARCEUTHINA. Zell. Norwich, Merton ; among fir.
- „ PRÆCOCELLA. Zell. (?) Norwich, once. I am not how-
ever satisfied about this species. If correct, it
probably had been introduced in juniper into
a garden.
- CEDESTIS FARINATELLA. Zell. Norwich, Merton ; among fir.
- OCNEROSTOMA PINARIELLA. Zell. Merton, Brandon, St. Faith's ;
among fir trees.
- ZELLERIA INSIGNIPENNELLA. Stn. Merton ; local.
- GRACILARIA SWEDERELLA. Thunb. Norwich, Merton ; among oak.
- „ STIGMATELLA. Fab. Norwich, Merton, Ranworth ;
among poplar and willow.

- GRACILARIA HEMIDACTYLELLA. Hüb. Merton.
- „ ELONGELLA. Linn. Merton, Ranworth; among alder.
- „ TRINGIPENNELLA. Zell. Norwich, Merton; among
Plantago lanceolata.
- „ SYRINGELLA. Fab. Common everywhere among lilac.
- „ OMISSELLA. Dougl. Norwich; among *Artemisia vulgaris*.
- „ AUROGUTTELLA. Steph. Merton, Ranworth; among
Hypericum quadrangulum.
- CORISCIMUM BRONGNIARDELLUM. Fab. Norwich, Merton.
- „ CUCULIPENNELLUM. Hüb. Merton; among privet.
- „ CITRINELLUM. Fisch. Merton, Sandringham.
- ORNIX AVELLANELLA. Stn. Norwich, Merton; among hazel.
- „ ANGLICELLA. Stn. Abundant everywhere among haw-
thorn.
- „ BETULÆ. Stn. Norwich; among birch.
- „ TORQUILLELLA. Stn. Norwich, Merton; among sloe.
- „ GUTTEA. Haw. Norwich; common among apple.
- COLEOPHORA ALCYONIPENNELLA. Koll. Norwich, Merton; among
Centaurea nigra.
- „ LIXELLA. Zell. Merton; scarce.
- „ ALBICOSTA. Haw. Norwich; among furze.
- „ ANATIPENNELLA. Hüb. Merton, St. Faith's.
- „ PALLIATELLA. Zell. Ranworth.
- „ IBIPENNELLA. Heyd. Merton, Ranworth.
- „ CURRUCIPENNELLA. Fisch. Ranworth; among willow.
- „ NIVEICOSTELLA. Fisch. Merton.
- „ DISCORDELLA. Zell. Norwich, Merton, Brandon, Ran-
worth; among *Lotus major*.
- „ GENISTÆ. Stn. Merton, St. Faith's; among *Genista*
anglica.
- „ SATURATELLA. Stn. Merton; among broom.
- „ ONOSMELLA. Zell. Norwich, Merton, Brandon; among
Echium vulgare.
- „ INFLATÆ. Stn. Merton; among *Silene inflata*.
- „ THERINELLA. Stn. Norwich; among thistles.
- „ TROGLODYTELLA. Stn. Norwich, Merton, Ranworth;
common among *Eupatorium cannabinum*.
- “ GRAMINICOLELLA. Heine. Ranworth; among *Lychuis*
flos-cuculi.

- COLEOPHORA LINEOLEA. Stn. Norwich, Merton; larva common on *Ballota nigra*.
- „ MURINIPENNELLA. Fisch. Norwich, Merton; among *Luzula sylvatica*.
- „ CÆSPITITIELLA. Zell. Generally common among rushes.
- „ ANNULATELLA. Teng. (TENGSTROMELLA, D.L.) Norwich, Merton, Brandon, St. Faith's; common among *Chenopodium*.
- „ SALINELLA. Stn. A larva on *Salsola kali*, brought by Mr. Bircham from Hunstanton, appears to belong to this species.
- „ APICELLA. Stn. (CACUMINATELLA, D.L.) Norwich, Merton, Ranworth; in marshes; not common.
- „ ARGENTULA. Zell. Norwich, Merton; common among *Achillea millefolium*.
- „ ARTEMESIELLA. Scott. Norwich; not common.
- „ JUNCICOLELLA. Stn. St. Faith's; among heath.
- „ LARICELLA. Hüb. Norwich, Merton; common among larch.
- „ ALBITARSELLA. Zell. Norwich; among *Glechoma hederacea*.
- „ NIGRICELLA. Steph. Norwich; abundant among hawthorn.
- „ FUSCEDINELLA. Zell. Norwich, Merton, Ranworth; common.
- „ GRYPHIPENNELLA. Bouché. Merton; among rose.
- „ VIMINETELLA. Zell. Merton, Ranworth; among sallow.
- „ SOLITARIELLA. Zell. Norwich; among *Stellaria holostea*.
- „ LUTIPENNELLA. Zell. Norwich, Merton, St. Faith's; common among oak.
- „ BADIIPENNELLA. Fisch. Norwich, Merton, St. Faith's; among hawthorn.
- „ LIMOSIPENNELLA. Fisch. Norwich; not common.
- „ CHALCOGRAMMELLA. Zell. Merton, Brandon; among *Cerastium arvense*; scarce.
- COSMOPTERYX ORICHALCEA. Stn. Merton, Ranworth, Barton Turf; in the fens; scarce.
- „ LIENIGIELLA. Zell. Ranworth; among reed; scarce.

- BATRACHEDRA PRÆANGUSTA. Haw. Norwich, Merton, Ranworth ;
among poplar and willow.
- „ PINICOLELLA. Zell. Near Norwich, Brandon, St. Faith's ;
among Scotch fir ; not rare.
- OINOPHILA V-FLAVA. Haw. Norwich, Merton ; in beer cellars,
larva feeding on fungi.
- CHAULIODUS ILLIGERELLUS. Hüb. Brundall, Merton, Ranworth ;
common in the fens.
- „ CHEROPHYLLELLUS. Goed. Norwich, Merton ; not common.
- LAVERNA PROPINQUELLA. Stn. Norwich, Surlingham ; in fens.
- „ EPILOBIELLA. Schr. Norwich, Merton, Wroxham, Ran-
worth ; common among *Epilobium hirsutum*.
- „ OCHRACELLA. Curt. Merton ; among *Epilobium*.
- „ PHRAGMITELLA. Bent. Brundall, Merton, Horning,
Ranworth ; probably everywhere among *Typha*
latifolia, in the heads of which the larva feeds.
- „ DECORELLA. Steph. Merton.
- „ SUBBISTRIGELLA. Haw. Merton.
- „ ATRA. Haw. (HELLERELLA, Dup. D.L.) Norwich, Mer-
ton ; common among hawthorn.
- „ RHAMNIELLA. Zell. Ranworth ; among *Rhamnus*.
- CHRYSOCLISTA FLAVICAPUT. Haw. Norwich, Brandon, Merton ;
common among hawthorn.
- ASYCHNA MODESTELLA. Dup. Norwich ; among *Stellaria holostea*.
- CHRYSOCORYS FESTALIELLA. Hüb. Merton, Ketteringham ; among
bramble ; not common.
- ANTISPILA PFEIFFERELLA. Fab. Merton ; among *Cornus san-*
guinea.
- STEPHENSIA BRUNNICHELLA. Linn. Norwich ; in chalk pits,
among *Clinopodium vulgare*.
- ELACHISTA GLEICHENELLA. Fab. Merton, Ranworth.
- „ MAGNIFICELLA. Tengs. Merton.
- „ ALBIFRONTILLA. Hüb. Norwich, Brundall, Merton ;
common.
- „ ATRICOMELLA. Stn. Norwich.
- „ LUTICOMELLA. Zell. Norwich ; common.
- „ P.O.E. Dougl. Merton ; among *Poa aquatica*.
- „ KILMUNELLA. Stn. Norwich, St. Faith's, Ranworth ;
among coarse grass in marshes.

- ELACHISTA CINEREOPUNCTELLA. Merton.
- „ GREGSONI. Stn. Merton.
- „ NIGRELLA. Hüb. Norwich, Merton; common.
- „ SUBNIGRELLA. Dougl. Merton.
- „ OBSCURELLA. Stn. Norwich.
- „ CERUSSELLA. Hüb. Norwich, Brundall, Merton, Brandon, Ranworth; common among reeds.
- „ RHYNCHOSPORELLA. Stn. Merton.
- „ PALUDUM. Frey. Surlingham, Ranworth; among *Carex* in the fens. Described by Mr. Stainton under the name of *caricis* in the "Entomologists' Annual," for 1859, from specimens obtained at Ranworth.
- „ BIATOMELLA. Stn. Yarmouth, Merton.
- „ TRIATOMEA. Haw. Norwich, Plumstead, Merton; common in chalk pits.
- „ RUFOCINEREA. Haw. Norwich, Merton; probably abundant everywhere among grass.
- „ CYGNIPENNELLA. Hüb. Norwich, Merton; common.
- TISCHERIA COMPLANELLA. Hüb. Norwich, Merton, St. Faith's; among oak.
- „ MARGINEA. Haw. (EMYELLA, Dup. D.L.) Norwich, Merton; common among bramble.
- LITHOCOLLETIS HORTELLA. Fab. Merton; very local.
- „ QUINQUEGUTTELLA. Stn. Merton, Ranworth; among dwarf willow.
- „ IRRADIELLA. Seott. Merton; among oak.
- „ LAUTELLA. Zell. Norwich, Merton, Horstead; among oak.
- „ POMIFOLIELLA. Zell. Norwich, Merton; doubtless everywhere among hawthorn and apple.
- „ CORYLI. Nieelli. Norwich, Merton, Horstead; among hazel.
- „ SPINICOLELLA. Zell. Horstead; among blackthorn.
- „ FAGINELLA. Mann. Norwich, Merton; common among beech.
- „ SALICICOLELLA. Sireom. Merton, Ranworth; among willow.
- „ CARPINICOLELLA. Stl. Merton, Horstead; among hornbeam; local.

- LITHOCOLLETIS ULMIFOLIELLA. Hüb. Merton; among birch.
- „ SPINOLELLA. Dup. Merton.
- „ QUERCIFOLIELLA. Fisch. Norwich, Merton; doubtless
common everywhere among oak.
- „ MESSANIELLA. Zell. Merton, Lynn, Holkham; common
among evergreen oak.
- „ CORYLIFOLIELLA. Haw. Norwich, Merton; common
among hawthorn.
- „ VIMINIELLA. Sircom. Merton; among willow.
- „ SCOPARIELLA. Fisch. Merton, St. Faith's; among broom.
- „ ULICICOLELLA. Vaughan. Norwich; common among
furze.
- „ ALNIFOLIELLA. Hüb. Norwich, Merton, St. Faith's,
Ranworth; common among alder.
- „ HEEGERIELLA. Zell. Merton; among oak.
- „ CRAMERELLA. Fab. Norwich, Merton; probably com-
mon everywhere among oak.
- „ SYLVELLA. Haw. (ACERIFOLIELLA, Zell. D.L.) Norwich,
Merton; among maple.
- „ PRÖLICHELLA. Zell. Merton; among alder.
- „ NICELLI. Zell. Merton, Horstead; among hazel.
- „ STETTINENSIS. Nicelli. Merton, Ranworth; among alder.
- „ SCHREBERELLA. Fab. Norwich, Merton; among elm.
- „ TRISTRIGELLA. Haw. Merton; among elm.
- „ TRIFASCIELLA. Haw. Norwich, Merton, Ringland;
among honeysuckle.
- LYONETIA CLERCKELLA. Linn. Norwich, Merton, St. Faith's.
- PHYLOCNISTIS SUFFUSELLA. Zell. Norwich; among poplar.
- „ SALIGNA. Zell. Merton; among willow.
- CEMIOSTOMA SPARTIFOLIELLA. Hüb. Norwich, Merton, Great
Plumstead, St. Faith's; among broom.
- „ LABURNELLA. Heyd. Norwich, Merton; among labur-
num.
- „ SCITELLA. Zell. Norwich, Merton; among hawthorn.
- „ LOTELLA. Str. Merton; among *Lotus major*.
- OPOSTEGA SALACIELLA. Tr. Norwich, Merton, Brandon; scarce.
- „ RELIQUELLA. Zell. Merton; rare. Recorded in Ent.
Ann, 1868. Possibly only a variety of
salaciella.

- OPOSTEGA AURITELLA. Hüb. Ranworth fen ; rare.
- „ CREPUSCULELLA. Fisch. Surlingham, Merton, Ranworth ;
common in the fens.
- BUCCULATRIX AURIMACULELLA. Stn. Norwich ; common among
Chrysanthemum leucanthemum.
- „ CIDARELLA. Fisch. Merton, Ranworth ; among alder.
- „ ULMELLA. Mann. Norwich, Merton ; among oak.
- „ CRATEGIFOLIELLA. Dup. Norwich, St. Faith's ; com-
mon about hawthorn hedges.
- „ MARITIMA. Stn. Yarmouth ; among *Aster tripolium*.
- „ BOYERELLA. Dup. Norwich ; among elm.
- „ FRANGULELLA. Gn. Ranworth ; common among *Rhamnus*.
- „ CRISTATELLA. Fisch. Norwich, Merton ; among yarrow.
- NEPTICULA ATRICAPITELLA. Haw. Norwich ; among oak.
- „ RUFICAPITELLA. Haw. Norwich ; among oak.
- „ PYGMEELLA. Haw. Norwich ; among hawthorn.
- „ OXYACANTHELLA. Stn. Merton.
- „ SEPTEMBRELLA. Stn. Merton ; among *Hypericum*.
- „ SUBBIMACULELLA. Haw. Norwich, Merton ; among oak.
- „ FLOSLACTELLA. Haw. Merton, Horstead ; among hazel.
- „ SALICIS. Stn. Ranworth ; among willow.
- „ MICROTHERIELLA. Wing. Horstead ; among hazel.
- „ IGNOBILELLA. Stn. Norwich ; among hawthorn.
- „ MALELLA. Stn. Norwich ; among wild apple.
- „ ATRICOLLIS. Stn. Norwich.
- „ ALNETELLA. Stn. Merton ; among alder.
- „ AURELLA. Fab. Norwich, Merton ; among bramble.
- TRIFURCULA IMMUNDELLA. Zell. Norwich, Merton ; among broom.
- „ PULVEROSELLA. Stn. Norwich ; among wild apple.
- BOHEMANIA QUADRIMACULELLA. Bohem. Ranworth ; among
alder ; local and scarce.

PTEROPHORINA.

- PLATYPTILIA BERTRAMI. Röss. Norwich, Merton, Thetford,
Cawston ; among yarrow.
- „ OCHRODACTYLA. Hüb. Horning ; among tansy.
- „ ISODACTYLUS. Zell. Norwich ; among *Senecio aquaticus*,
in marshes.

- PLATYPTILIA TRIGONODACTYLUS. Haw. Cawston.
- AMBLYPTILIA ACANTHODACTYLA. Hüb. Norwich, Aldeby, Cawston, Cromer, St. Faith's; on heaths.
- OXYPTILUS TEUCRII. Greening. Near Norwich; among *Teucrium scorodonia*. This appears to me to be the species noticed by Haworth, Stevens, and Donovan, in Norfolk, under the name of *didactyla*, and also recorded at Yarmouth by Paget, under the same name.
- „ LÆTUS. Zell. Merton, Thetford, and probably at Brandon, where it occurs on the Suffolk side of the river. It appears, in this country, to be confined to the "Breck-sand" district, where it was discovered by Lord Walsingham, in July, 1868.
- MIMLESEOPTILUS BIPUNCTIDACTYLUS. Haw. Norwich, Merton, Cawston, Ranworth; among *Scabiosa succisa*.
- „ PLAGIODACTYLUS. Fisch. Norwich, Merton; common among *Scabiosa columbaria*.
- „ LOEWII. Zell. (ZOPHODACTYLUS, Dup.) Near Norwich, Merton; among *Erythraea centaurium*.
- „ FUSCUS. Reiz. (PTERODACTYLUS, Linn.) Norwich, Merton, Cawston, St. Faith's; common among *Veronica chamaedrys*.
- CEDEMATOPHORUS LITHODACTYLUS. Tr. Hunstanton; among *Imula dysenterica*.
- PTEROPHORUS PTERODACTYLUS. Hüb. (MONODACTYLUS, Linn.) Norwich, Merton, Thetford, Cawston; common among convolvulus.
- LEIOPTILUS LIENIGIANUS. Zell. Norwich, Ringland, Horning; among *Artemisia vulgaris*.
- „ TEPHRADACTYLUS. Hüb. Recorded at Beachamwell by Stephens, but not since observed. Possibly a mistake.
- „ MICRODACTYLUS. Hüb. Merton, Ranworth; among *Eupatorium cannabinum*.
- „ BRACHYDACTYLUS. Tr. The only recorded occurrence of this species in Great Britain was in Norfolk, where it is said to have been taken by a Mr.

Farr thirty years ago. He removed to London about 1844, and is since deceased, and I have no idea what has become of his insects, nor of the locality in which this species was captured. No recent examples are known.

ACIPTILIA GALACTODACTYLA. Hüb. Norwich, Sparham; among burdock.

„ PENTADACTYLA. Linn. Generally abundant among *Convolvulus sepium* and *arvensis*.

ALUCITINA.

ALUCITA POLYDACTYLA. Hüb. Norwich, Merton, Lynn, Cromer, Sparham, Cawston; among honeysuckle.

A glance at the foregoing list will make it very evident that, while the larger and more conspicuous species have been pretty carefully worked up, and their localities recorded, the smaller have been much neglected—indeed, I have but two or three lists in which they are included. Consequently there is every reason to suppose that at some future time there may be considerable additions to be made, particularly in the groups of the Tortrices and Tineæ.

An analysis of the list shows that of the Butterflies we have in the county forty-eight species, nearly four-fifths of the entire British list; of the Nocturni (Sphinges and Bombyces of Linné) seventy-four species, or about five-eighths; and of the Geometræ, one hundred and ninety, or exactly two-thirds. The same proportion, or nearly, holds good in the other large group of Macro-Lepidoptera, the Noctuæ, of which we have two hundred and twenty species; while of the Drepanulæ our five species constitute five-sixths, and of the Pseudo-Bombyces our nineteen species equal five-sevenths. Of the Deltoides we have nine species, about three-fifths; of the Pyralides forty-four species, only five-eighths; and of the Crambites fifty-four species, little more than the same proportion; while of the Aventiæ we possess the single European representative. Of the Tortrices, however, we have but two hundred species, not two-thirds; and of the Tineina only three hundred and sixty species, very little more than one-half; while

our twenty species of Pterophorina constitute about four-sevenths of the British list. When the woods of the west and north of Norfolk, and its extensive coast line have been carefully worked, I suspect that these proportions will be somewhat altered.

Of species apparently confined solely to this county, as far as the British Islands are concerned, we have six, four of which—*Lithosia muscerda*, *Nonagria brevilinea*, *Crambus paludellus*, and *Sericoris doubledayana*, are confined to the fens, one, *Crambus fascelinellus*, inhabits the sandy dunes at Yarmouth; and one, *Nothris verbascella*, is attached to the very local *Mullein*, *Verbas-cum pulverulentum*, which grows so abundantly round Norwich.

While the Norfolk fens produce several species which do not appear to occur in those of Cambridgeshire, the latter are favoured with the presence of a number of which I can find no reliable record in Norfolk. Conspicuous among these are *Phragmatocia arundinis*, *Hypercompa dominula*, *Orgyia cœnosa*, *Noctua subrosea*, *Pionea margaritalis*, *Nascia ciliaris*, *Dictyopteryx lorquiniana* (*uliginosana*.) and *Argyrolepia schreibersiana*. As the speedy extinction of most of these species in the Cambridge fens is a matter of probability amounting almost to certainty, it would be of great service to Entomology that they should, if possible, be transplanted into the fens of Norfolk, where they would have room to increase and multiply. This has been attempted, in the case of the two first-named species, during the last year, but probably not to a sufficient extent to ensure their permanent establishment. Although these few are absent, an inspection of the list will show that the fens contribute a very large proportion of our most local and interesting species.

The chalk districts round Norwich produce some uncommon and little known species, such as *Homœosoma nebulella*, *Argyrolepia subbaumanniana*, *Eupœecilia degreyana*, *Stephensia brunnichella*, and others; and the sandhills of the coast are favoured by the presence of such rarities as *Agrotis ripæ*, *Nyetegretes achatinella* and *Eupœecilia pallidana*, while many of the commoner coast sandhill species are found also on the singular stretch of postglacial sea-sands at Thetford, Brandon, and their neighbourhood. This district also appears to form the head-quarters of a number of species so excessively local in their distribution, that they were formerly considered to be among the rarest of our British insects.

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Of these *Lithostegia griseata*, *Acidalia rubricata*, *Agrophila sulphuralis*, *Tinea imella*, and *Gelechia vilella*, are more particularly noticeable, with the pretty little "Plume," *Oxyptilus lætus*, which appears to be entirely confined to this part of Norfolk and Suffolk.

In conclusion I may mention, that the peculiar nature of the geological formation and physical features of the county has the effect of causing very many species to be confined to exceedingly restricted localities, but that the climate is evidently favourable to their increase, since in these favoured spots they often occur in great abundance. To this peculiarity of the county local Entomologists may look as a reason for expecting to find many species which have not been noticed, and I sincerely hope, that the publication of this list may be the means of stirring them up to increase it far beyond the twelve hundred and forty species of which it at present consists.

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THE END.







