

Biometrika Trust

Author(s): Oswald H. Latter

Source: Biometrika, Vol. 1, No. 2 (Jan., 1902), pp. 164-176

Published by: Oxford University Press on behalf of Biometrika Trust

Stable URL: https://www.jstor.org/stable/2331486

Accessed: 09-05-2019 17:25 UTC

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at https://about.jstor.org/terms



 ${\it Biometrika\ Trust,\ Oxford\ University\ Press\ are\ collaborating\ with\ JSTOR\ to\ digitize,} \\ preserve\ and\ extend\ access\ to\ {\it Biometrika}$

THE EGG OF CUCULUS CANORUS.

AN ENQUIRY INTO THE DIMENSIONS OF THE CUCKOO'S EGG AND THE RELATION OF THE VARIATIONS TO THE SIZE OF THE EGGS OF THE FOSTER-PARENT, WITH NOTES ON COLORATION, &c.

By OSWALD H. LATTER.

[Received October 2, 1901.]

Introductory.

THE present paper is the outcome of an examination of 44 Cuckoo's eggs in the collections at the Charterhouse Museum. The results of this preliminary investigation were communicated to the Congress of South Eastern Natural History Associations, held in the summer of 1901 at Haslemere, under the auspices of the Haslemere Microscope and Natural History Society, of which I have the honour to be a member. Finding that 44 was far too small a number of eggs for my purpose I extended the series of measurements by including a large number obtained at the British Museum of Natural History, S. Kensington, and I may here take the opportunity of expressing my thanks to the Director, Prof. Ray Lankester, and Mr Ogilvie Grant for granting me permission to examine the fine series under their care, and also to Mr Baldwin Young of Sheffield, who kindly supplied measurements of six Cuckoo's eggs in his possession. The total number of Cuckoo's eggs measured and included in this enquiry is 243, of which 223 were known to have been deposited in the nests of 42 different species of birds, while the foster-parents of the remaining 20 were not ascertainable; these 20 have not been excluded from the calculations, for their effect upon the value of mean length and breadth is practically negligible. In dealing with coloration, a further 45 which were not accessible for purposes of measurement have been included, bringing the total to 288. All measurements were taken with sliding callipers reading to millimetres, the decimal parts of a millimetre being estimated by eye aided with a strong lens. The dimensions measured are greatest length and greatest breadth.

It has been established by many observers that the female Cuckoo lays her egg upon the ground and then taking it in her beak puts it into the nest of the foster-parents of her offspring. An explanation is needed of the success which attends this imposition. Are the foster-parents deceived either by similarity of colouring or of size into fancying the Cuckoo's egg to be one of their own? or are they indifferent to these qualities? or are some small birds more expert than others in detecting fraud?

The theory which finds more favour than others is that put forward by Prof. A. Newton (Dictionary of Birds, p. 123); who, after mentioning the history of speculation on the matter, writes as follows:—"Everyone who has sufficiently studied the habits of animals will admit the tendency of some of these habits to become hereditary. That there is a reasonable probability of each Cuckow most commonly putting her eggs in the nest of the same species of bird, and of this habit being transmitted to her posterity, does not seem to be a very violent supposition. Without attributing any wonderful sagacity to her, it does not seem unlikely that the Cuckow which had once successfully foisted her egg on a Reed-wren or a Titlark should again seek for another Reed-wren's or another Titlark's nest (as the case may be)......and that she should continue her practice from one season to another...... Such a habit could hardly fail to become hereditary, so that the daughter of a Cuckow which always put her egg into a Reed-wren's, Titlark's, or Wagtail's nest, would do as did her mother and it can hardly be questioned that the eggs of the daughter would more or less resemble those of her mother. Hence the supposition may be fairly regarded that the habit of laying a particular style of egg is also likely to become hereditary The particular 'gens' of Cuckow which inherited and transmitted the habit of depositing in the nest of any particular species of bird eggs having more or less resemblance to the eggs of that species would prosper most in those members of the 'gens' where the likeness was strongest, and the other members would (caeteris paribus) in time be eliminated...... The operation of this kind of natural selection would be most needed in those cases where the species are not easily duped—that is in those cases which occur the least frequently. Here it is we find it, for observation shows that eggs of the Cuckow deposited in the nests of the Red-backed Shrike, of the Bunting, of the Red Start and of the Icterine Warbler approximate in their colouring to eggs of these species—species in whose nests the Cuckow rarely (in comparison with others) deposits eggs."

I must confess that I approached this investigation with decided scepticism as to the validity of Prof. Newton's theory. It is very doubtful whether the Cuckoo is aware that she has "successfully foisted her egg on a Reed-wren" or on any other bird: so far as is known she takes no further interest in the egg—it may

escape detection, it may be ejected. Moreover, the theory seems to demand that male Cuckoos should mate with female Cuckoos reared by foster-parents of the same species, or else that the inherited habits and characters of every female Cuckoo should follow only the female line of descent. For suppose a Reed-wrenreared female Cuckoo to mate with a Robin-reared male Cuckoo, then their offspring might be reasonably expected to inherit some characters from each parent and to possess mixed tendencies, some urging them to lay in Robins' nests and others in those of Reed-wrens, and, unless inheritance run only in the female line (or mating taking place only between individuals of like foster-parentage), the tendencies would get further mingled in each succeeding generation. criticism appears to me to apply with equal force to Reh's theory of the intuitive selection of the nests of the species by which the Cuckoos themselves were reared. Further, there is very little, if any, evidence in support of the operation of natural selection in eliminating eggs that do not match those of the clutch into which they have been introduced. I have not come across any record of such badlymatched Cuckoo's eggs having been found ejected from the nest. Lastly, it is very difficult to conceive how perfection of colour-matching can have arisen by natural selection with relatively few opportunities for the working of this force; and, if the case be as Prof. Newton states, I certainly should have expected to find a large number of Cuckoo's eggs in the nests of those birds whose eggs had at length been so admirably copied.

Size-Matching.

In spite of these criticisms I am compelled by the results of my investigations to admit that I now believe Professor Newton's theory to be in the main correct: I will return to this point later. It will be seen by the appended summary of results and tables of measurements that the mean length (22.40 mm.) and mean breadth (16.54 mm.) of 243 Cuckoo's eggs are respectively greater than the mean lengths and breadths of the eggs of any of the four species [viz. Anthus pratensis, the Meadow Pipit; Anthus trivialis, the Tree Pipit; Accentor modularis, the Hedge Sparrow, and Erithacus rubecula, the Robin], of whose eggs I was able to measure a reasonable number. The range of length extends from 19·1 mm. to 25.0 mm.; that of breadth from 14.0 mm. to 18.8 mm.: the standard deviation (σ) of length being 1.058, and the coefficient of variation (C. of V.) of length 4.72, those of breadth being respectively 0.6496 and 3.93. Of the four species which serve as foster-parents and are here dealt with, the Meadow Pipit alone exceeds the Cuckoo in degree of variation, but it must be remembered that the number of measured eggs of Robins and other species is very much less than in the case of the Cuckoo, so that it is quite possible that the Cuckoo does not differ greatly from other birds in this respect*. It is however interesting to note that in

^{*} Further, the Cuckoo's eggs were probably laid by about 200 separate hens, while the 74 Meadow Pipit's eggs, for example, are formed by 20 clutches or due to 20 hens only.

each of the five species length of egg is a far more variable dimension than breadth: this is probably due to uniformity of diameter of the oviduct, and it may also be of importance to the comfort of the female bird during the period of incubation, for an egg projecting far above its fellows in consequence of greater breadth would probably inconvenience the sitter.

My enquiry has thus resolved itself chiefly into an attempt to ascertain (1) if the eggs of Cuckoos deposited in the nests of any one species stand out as a set apart from Cuckoo's eggs deposited elsewhere; (2) if the same eggs depart from the rest in such a direction as to approximate in size to the eggs of that particular species of foster-parent. The method employed is to find the mean (M) length or breadth, as the case may be, thence to compute the standard deviation (σ) by the formula $\sigma^2 = \frac{\sup (M-x)^2}{n}$, where x = the measurement of

any one egg and n =the number of eggs measured: and then to find $\frac{100 \sigma}{M}$, the coefficient of variation. To test whether any deviation is significant, M_r is taken as the mean of the whole race of Cuckoos and M_s the mean of Cuckoo's eggs found in the nest of any one species of foster-parent: the standard deviation (σ_s) of such eggs is also ascertained. The value of $M_r - M_s$ is then compared with that of $0.67449 \sqrt{\frac{\sigma_r^2}{n_1} + \frac{\sigma_s^2}{n_2}}$, where $n_1 = \text{total number of Cuckoo's eggs and } n_2 = \text{the number}$ of Cuckoo's eggs in the nests of the species in question, which is the probable error of $M_r - M_s$ due to random sampling. If the value of $M_r - M_s$ be not at least 1.5 to 3 times as great as the value of the other expression the difference of M_r and M_s is not definitely significant. Referring now to the tabulated summary below, it will be seen that in the matter of length, the eggs of Meadow-Pipit-Cuckoos (to coin a convenient phrase), of Wagtail-Cuckoos (this includes all species of Wagtails, for their eggs are very similar), and of Robin-Cuckoos, do not differ significantly from those of the whole race of Cuckoos, but those of Hedge-Sparrow-Cuckoos, Tree-Pipit-Cuckoos and of Wren-Cuckoos certainly do present differences marking them out as distinct sets. On the other hand in the matter of breadth the differences are significant in the cases of Meadow-Pipit-Cuckoos, Hedge-Sparrow-Cuckoos and Wren-Cuckoos. It therefore seems highly probable that there are certain "gentes" of Cuckoos whose members being closely related lay eggs of somewhat similar dimensions and in the main confine their attentions each to its own particular variety of foster-parent. Breadth, as I have already pointed out, seems more likely than length to be a disturbing factor in the nest of the foster-parent if it in any marked way depart from the normal, and it is very remarkable to note how very low are four of the values of σ_s in the breadth tables, viz. 2.28 (Meadow-Pipit-Cuckoo), 2.58 (Wagtail-Cuckoo), 2.65 (Tree-Pipit-Cuckoo), 1.92 (Wren-Cuckoo).

Next, as to whether these sets differ from the main body in the sense of the particular species of foster-parent. In the Wren-Cuckoos this is so beyond

Summary.

	Le	ngth in	millimetre	3	
Species	Number of Eggs	Mean (M)	Standard Deviation (σ)	Coefficient of Variation	Significance Test (Ratio of difference to its probable error)
Cuculus canorus	243	22.4	1.0585	4.72	
C. canorus-Anthus pratensis (Meadow-Pipit-Cuckoo)	45	22.3	0.8933	4:00	difference not significant (1·1)
Anthus pratensis	74	19.7	1.2504	6:37	umorenee net signmesme (= =)
C. canorus-Accentor modularis					
(Hedge-Sparrow-Cuckoo)	14	23.1	1.0116	4.37	difference significant (3.71)
Accentor modularis	26	20.0	0.8096	4.02	
C. canorus-Erithacus rubecula	10	00.5	0.000	2.50	difference not significant (1.25)
(Robin-Cuckoo) Erithacus rubecula	16 57	22·5 20·2	0.6628 0.8565	4.24	difference not significant (1 25)
C. canorus-Motacilla, sp. 4	01	202	0 0000	121	
(Wagtail-Cuckoos)	26	22.6	0.8783	3.88	difference not significant (1.25)
Wagtails estimated		19.9			
C. canorus-Anthus trivialis					1.00
(Tree-Pipit-Cuckoo)	15	23.1	0.8504	3·68 3·489	difference significant (4.5)
Anthus trivialis C. canorus-Troglodytes parvu-	27	20.0	0.6978	3.459	
lus	15	21.1	0.7558	3.58	difference significant (9.3)
Troglodytes parvulus	Estimated	17.7	0,000		allocolloc organization (c c)
gyy	from				
	W. J. Gordon	l			
	Bre	eadth in	n millimetre	es	
Cuculus canorus C. canorus-Anthus pratensis	243	16.5	0.6496	3.93	
(Meadow-Pipit-Cuckoo)	45	16.7	0 ·3 815	2.28	difference significant (3.4)
Anthus pratensis	74	14.6	0.5611	3.84	
C. canorus-Accentor modularis	14	16.8	0.5161	3.07	difference significant (2.4)
(Hedge-Sparrow-Cuckoo) Accentor modularis	14 26	16.8	0.3161	3.07 2.81	dinerence significant (2 4)
C. canorus-Erithacus rubecula	20	441	0 311	201	
(Robin-Cuckoo)	16	16.4	0.5326	3.24	difference not significant (.96)
Erithacus rubecula	57	15.4	0.4771	3.09	
C. canorus-Motacilla, sp. 4			0.4000	0.50	1:00
(Wagtail-Cuckoos)	26	16.6	0.4389	2.58	difference not significant (.93)
Wagtails estimated C. canorus-Anthus trivialis		14.9			
(Tree-Pipit-Cuckoo)	15	16.6	0.4397	2.65	difference not significant ('75)
Anthus trivialis	27	15.1	0.4488	2.97	and the significant (10)
C. canorus-Troglodytes parvu-					
lus	15	15.8	0.3042	1.92	difference significant (12:3)
Troglodytes parvulus	Estimated	12.7			
	from W. I. Cordonia				
	W. J. Gordon's "Our Country's				
	Birds"				
	240			1	

doubt. Unfortunately I had not material sufficient to determine trustworthy means of length and breadth of Wren's eggs, but I have estimated them from measurements given in inches by W. J. Gordon in Our Country's Birds, and feel confident that no error of any importance exists in his figures, for the measurements given by him of other species' eggs approximate very closely with the means obtained by myself in each case. It will be seen that the egg of the Wren is far smaller than that of any other species with which we are dealing, and that the lengths and breadths of Wren-Cuckoos' eggs are very much less than those of other Cuckoos. For the other species where the differences are significant this sense of the variation is not clear so far as it concerns breadth, though it appears to be so in the matter of length: the two subjoined tables give the comparison.

	Mean L	Mean Length				
Hedge-Sparrow-Cuckoo	23·1	Hedge-Sparrow		20.1		
Tree-Pipit-Cuckoo	23.1	Tree-Pipit	• • •	20.0		
Meadow-Pipit-Cuckoo	22.3	Meadow-Pipit		19.7		
Wren-Cuckoo	$21 \cdot 1$	Wren		17.7		

	Mean B	Breadth			
	16.8	Tree-Pipit		15.1	
Meadow-Pipit-Cuckoo	16.7	Hedge-Ŝparrow	•••	14.7	
Tree-Pipit-Cuckoo	16.6	Meadow-Pipit	•••	14.6	
Wren-Cuckoo		Wren			

Colour-matching.

As already stated, 288 Cuckoo's eggs were examined in this connection and compared with the eggs among which they had been deposited. In 39 cases the matching was extremely close, and in a further 109 there was a fair approximation, rendering the Cuckoo's egg more or less similar in appearance to those of the foster-parent, the two categories giving a total of 148 eggs more or less closely matched to their several clutches, or at any rate within the limits of colour-variations exhibited by the species in question. Reh has observed this last same phenomenon in nests of the Red-backed Shrike (Lanius collaris), and eggs of this description possess an especial interest, for they seem to afford very strong support to Prof. Newton's theory. It is a fairly frequent occurrence to find in the nests of birds whose eggs exhibit considerable variation of colour, e.g. Meadow-Pipit, Tree-Pipit and Reed-Warbler, a Cuckoo's egg, not resembling the particular clutch in which it occurs but which would match eggs of another clutch of the same species. On the other hand, I found but three instances of Cuckoo's eggs with a close resemblance to eggs of any one species being deposited elsewhere than in the nests of that species, viz. egg No. 152 found in nest of Lesser Whitethroat is a good match to a Meadow-Pipit's eggs; No. 173 in nest

Biometrika 1 14

of Chaffinch matches Wagtail's eggs; No. 187 in Nightingale's nest matches House-Sparrow's (very variable) eggs.

Colour-matching.

300000 1100	Cotom matering.							
Good	Not matched nor within limits of colour-variation of egg							
11 Meadow-Pipit	17 Wren							
7 Wagtails								
6 Orphean-Warbler	19 Hedge-Sparrow 11 Robin							
4 Garden-Warbler	12 Yellow-Ammer							
3 Red-Start								
1 Robin	13 Reed-Warbler							
1 Sedge-Warbler	4 Garden-Warbler							
1 Barred-Warbler	6 Meadow-Pipit							
1 Aquatic-Warbler	4 Tree-Pipit							
1 Whitethroat	5 Willow-Warbler							
1 Wheatear (sp. Saxicola melanoleuca	5 Greenfinch							
	4 Chaffinch							
1 Pied-Flycatcher	4 Linnet							
1 Hedge-Sparrow	3 Pied-Wagtail							
	2 Blackcap							
Total 39	2 Red-Start							
	2 Lesser-Whitethroat							
	2 Nightingale							
	2 Wood-Warbler							
	2 Spotted-Flycatcher							
	2 Sedge-Warbler							
Fair, or within limits of colour-	2 Red-backed-Shrike							
variation of egg of species	1 Woodchat-Shrike							
45 Meadow-Pipit	1 Rock-Pipit							
19 Wagtails	1 Sky-Lark							
11 Tree-Pipit	1 Crested-Lark							
7 Reed-Warbler	1 Goldfinch							
6 Robin	1 House-Sparrow							
5 Blackcap	1 Common-Bunting							
4 Whitethroat	1 Cirl-Bunting							
2 Marsh-Warbler	1 Great-Reed-Warbler							
2 Sedge-Warbler	1 Marsh-Warbler							
2 Red-backed-Shrike	1 Grasshopper-Warbler							
1 Lesser-Grey-Shrike	1 Dartford-Warbler							
1 Lesser-Whitethroat	1 Barred-Warbler							
1 Tree-Sparrow	1 Wheatear							
1 Common-Bunting	1 Orphean-Warbler							
1 Sky-Lark	1 Chiffchaff							
1 Crested-Lark	1 Fire-Crested-Wren							
Total 109	Total 140							

The appended table of colour-matching gives in a concise form the more important numerical facts. The total number of successes, complete or partial, in colour-matching is so great, nearly 51.4% of the whole series examined, that mere chance is impossible as an explanation. Moreover, the accuracy with which highly remarkable Cuckoo's eggs are deposited in appropriate clutches is so

striking as to tempt one to dally with conscious selection and deliberate choice on the part of the female Cuckoo: for instance, six blue Cuckoo's eggs occur in the series, of these three were in Red Starts' nests (Nos. 155, 158, and one not accessible for measurement), one (No. 159) in nest of Saxicola melanoleuca, and two others (not accessible) in nests of Hedge-Sparrow and Pied-Flycatcher. All these birds lay blue eggs, and so far as my observations go, blue Cuckoo's eggs are not deposited elsewhere, though Howard Saunders's statement (Manual of British Birds, p. 288) that "these, (sc. blue eggs), have not been invariably located in nests of the Hedge-Sparrow and the Red Start" leads me to suppose that they may have been found in the nests of birds whose eggs are not blue. Again, the egg of the Orphean Warbler is of a very distinct type, and yet in six cases out of seven the Cuckoo's egg deposited in the nest of this species resembles this type to a nicety, nor is this particular variety of Cuckoo's egg to be found in any other nest.

	Matched more or less	Not matched	Total	Percentage matched
Meadow-Pipit Wagtails Hedge-Sparrow Robin Reed-Warbler Tree-Pipit Wren Yellow-Ammer Garden-Warbler	56 26 1 7 7 11 0 0	6 3 19 11 13 4 17 12	62 29 20 18 20 15 17 12 8	90·3°/ ₀ 89·6°/ ₀ 5·0°/ ₀ 38·8°/ ₀ 35·5°/ ₀ 0·0°/ ₀ 50·0°/ ₀
Orphean-Warbler	6	ī	7	85.7 %

Perhaps the most striking point in connection with colour-matching is its entire absence from the eggs of Wren-Cuckoos, which, though closely resembling one another, in no case match those of the Wren itself. The Wren is the only bird of those dealt with in this paper that constructs a nest of such a character as to render a view of the eggs impossible alike to the Wren and the Cuckoo; hence failure in colour-matching cannot possibly reveal the intruder to the lawful owner and discrepancy in size becomes of more importance. It is very remarkable that, in both length and breadth, as already pointed out, the eggs of Wren-Cuckoos show a far wider variation from the average Cuckoo and in the direction of the Wren's egg than is the case with any other species. It is too a well known fact that the Wren is peculiarly intolerant of interference with her nest—at any rate at the hands of human beings.

To sum up, we note that there are three cases of practically no colour-matching, the Hedge-Sparrow-Cuckoo, the Wren-Cuckoo and the Yellow-Ammer-Cuckoo; in the first two of these cases there is an attempt both as to length and breadth at size-matching. In the third case no significant size-difference is to be found from our data, but these are too scant to be really conclusive.

In spite then of the criticisms expressed above and of the absence of actual

14--2

evidence of the ejection of Cuckoo's eggs by small birds, I feel compelled to admit that there is a selective process at work, tending, in many cases, to bring the Cuckoo's eggs into agreement with those of the host both in size and colour, and am inclined to suggest that perhaps there may be local "gentes" of Cuckoos which as a rule, but by no means exclusively, patronise the nests of particular species. It seems well established (1) that a Cuckoo returns every year to the same locality, and (2) according to Reh, lays its eggs only in the nests of that particular species which it, or its ancestors, happen to have adopted for that purpose, while the coloration of the egg of every female Cuckoo is peculiar to itself. The evidence that my material furnishes on these points is as follows:—the Cuckoo's eggs in the South Kensington Collection from any one locality frequently exhibit strong resemblances inter se, e.g. (a) Nos. 107, 108, 109 (Robin-Cuckoo), 180 (Greenfinch-Cuckoo), 189 (Spotted-Flycatcher-Cuckoo), and 61 (Meadow-Pipit-Cuckoo), all taken at Churt in the year 1860, are all so closely similar that they may well be from one and the same bird; (b) Nos. 25 and 26 (Meadow-Pipit-Cuckoo) from Lochend, but not dated; (c) Nos. 34 and 35 (both in same nest of Meadow-Pipit) from S.W. Lancashire, dated June 29, 1866, and 33 (Meadow-Pipit-Cuckoo) from N.W. Cheshire, dated 25 May, 1866, and all three collected by H. E. Smith; (d) No. 193 (Red-backed-Shrike-Cuckoo, June, 1863), 110 (Robin-Cuckoo, June, 1863), 195 (Skylark-Cuckoo, May, 1862), 181 (Greenfinch-Cuckoo, 1864), 243 (Linnet-Cuckoo, June, 1864), and 168 (Yellow-Ammer-Cuckoo, June, 1864), all coming from Churt, and (e) Nos. 225-236 (Wren-Cuckoo), Pomerania, 1879, 1880 and 1881, exhibit the same phenomenon in their several sets. But it is to be observed that eggs of the same coloration are not confined to the nests of any one species of foster-parent, except in (c) and (e). Again, eleven nests contained two Cuckoo's eggs apiece, viz. Nos. 28 and 29, 34 and 35, 36 and 37, 38 and 39, and two others not accessible for measurement, all in Meadow Pipits' nests, 139 and 140 in Orphean Warblers', 210 and 211 in Pied Wagtails', 214 and 215, 217 and 218 in Pied Wagtails', and 145 and 146, 147 and 148 in Reed Warblers', and in each case the two eggs are obviously laid by the same parent. Reh mentions the fact that in 1893 within two kilometres from Leipzig no less than 70 nests were found containing Cuckoo's eggs, and of these, 58 (83%), were in nests of Red-backed Shrike. It seems possible then that in any given locality a majority of the Cuckoos may favour some one particular species of foster-parent, and if this be so the chances of male and female Cuckoos of like rearing mating together are very largely increased, and the difficulty raised in a preceding passage is to some extent removed. It is however evident that the isolation of "gens" from "gens" is not perfect, and this may perhaps be accounted for by occasional matings between birds of unlike foster-parentage and the offspring inheriting mixed tendencies.

In conclusion I must acknowledge my great indebtedness to Professor Karl Pearson for the interest he has taken in this investigation and for much kind advice and assistance in the statistical portions.

APPENDIX I. Cuckoo (C. canorus). Length of Egg in millimetres.

(The names of species refer to the nest in which the eggs were found.)

Clutch Unknown	·	-			
J. 3256 66. 327 122. 209 162. 225 198. 230 3. 333 68. 240 Sedge-Warbler 164. 325 300. 340 323 5. 231 70. 221 122. 230 165. 232 300. 240 324 300. 240 324 300. 240 323 5. 231 70. 221 122. 210 166. 232 300. 240 300. 240 323 302. 241 300. 240 322 302. 231 300. 240 322 302. 231 300. 240 322 302. 231 300. 240 322 302. 231 302. 232 302. 231 302. 232 302. 232 302. 232 302. 232 302. 232 302. 232 302. 232 302. 232	Clutch Unknown	Tree-Pipit	Chiffchaff	Yellow-Ammer	Pied-Wagtail
2. 201 67. 233 62.40 125. 236 165. 233 20. 234 4 229 66. 236 125. 230 165. 233 20. 233 20. 233 65. 231 70. 221 124. 210 166. 232 200. 240 20. 236 226 125. 230 165. 233 20. 233 20. 233 20. 233 20. 233 20. 233 20. 233 20. 233 20. 233 20. 234 20. 233 20. 234 20. 233 20. 234 20. 233 20. 234 20. 233 20. 234 20. 233 20. 234 20. 233 20. 234 20. 233 20. 234 20. 233 20. 234 20. 233 20. 234 20. 233 20. 234 20. 233 20. 234 20. 233 20. 234 20. 234 20. 235 20. 240 20. 237 20. 237 20. 238 20. 239 20. 24 20. 239 20. 24 20. 239 20. 24 20. 239 20. 24 20. 239 20. 24 20. 239 20. 24 20. 239 20. 24 20. 239 20. 24 20. 239 20. 24 20. 239 20. 24 20. 239 20. 24 20. 239 20. 24 20. 239 20. 24 20. 229 20.	1	-	i i		-
5. 233 68. 240 68. 240 70. 32-1 128. 230 0 165. 23-2 20. 20. 22-1 29. 240 12-3. 20. 165. 23-3 200. 23-1 22. 21 1 126. 220 167. 23-0 200. 23-2 20. 22-1 22. 20 167. 23-0 200. 23-2 20. 20. 22-3 200. 23-3 200. 23-3 200. 23-3 200. 23-3 200. 23-3 200. 23-3 200. 23-3 200. 23-3 200. 23-3 200. 23-3 200. 23-3 200. 23-3 200. 23-3 200. 23-3 200. 23-3 200. 23-3 200. 23-3 200. 23-3 200. 24-9 200. 21-3 <t< td=""><td></td><td></td><td></td><td></td><td></td></t<>					
4. 229 69, 23-6 6. 231 70, 22-1 124, 21-0 165, 23-3 201, 23-3 6. 22-0 71, 21-8 124, 21-0 166, 23-2 202, 23-1 203, 22-4 203, 22-4 203, 22-4 203, 22-4 203, 22-4 203, 22-4 203, 22-4 203, 22-4 204, 22-3 202, 23-1 204, 22-3 202, 23-1 204, 22-3 206, 24-9 205, 22-9 205, 21-8 206, 21-8 206, 21-8 207, 24-0 207, 24-0 207, 24-0 207, 24-0 207, 24-0 207, 24-0 207, 24-0 207, 24-0 207, 24-0 207, 24-0 207, 24-0 207, 24-0 209, 21-0 209, 21-0 207, 24-0 209, 21-0			Sedge-Warbler		
6. 231 70. 221 121.8 220 71. 21.8 125. 220 167. 230 203. 22. 231 72. 21.1 126. 21.3 168. 21.1 204. 21.8 20.3 20.3 29.4 20.5 21.8 23.3 20.6 24.9 20.5 21.8 23.3 20.6 24.9 20.2 21.1 20.2 21.9 20.2 21.0 20.2 21.0 20.2 21.0 20.2 21.0 20.2 21.0 20.2 21.0 20.2 21.0 20.2 21.0 20.2 21.1 21.7 20.1 20.2 21.2 20.2 21.2 21.2 21.2 21.2 21.2 21.2 21.2 21.2 21.2 21.2 21.2 21.2 21.2			123. 23.0		
6. 220 71, 21-8					
7. 223					
8. 236 73, 2344 Wood-Warbler 169, 229 296, 2148 206, 2148 20, 247 74, 2348 206, 2149 206, 2148 207, 2410 20, 2118 200 207, 2410 20, 2410 20, 2410 20, 2118 200 207, 2410 20, 211 20, 212 204 77, 2375 232 Willow-Warbler 177, 201 209, 2110 226 209, 2110 202, 2110 208, 2321 2113 15, 2219 210, 226 209, 2110 212, 201 209, 2110 226 209, 2110 212, 201 208, 2311 213 178, 2299 210, 226 209, 2110 226 211, 211 211 211 211 211 211 211 211 211 211 212 241 220 211 211 212 241 241 211 211 212 241 220 211 211 212 241 220 211 211 212 241 220 211 212 241 220 211 221 211 222<					
9. 247			120. 215		
10. 937			Wood Worklor		
11. 240 76. 240 128. 220 Corn-Bunting 208. 221 12. 290 27. 235 27. 220 79. 240 37. 235 27. 221 27. 229 27. 220		74. 200		170. 200	
12. 204				Com Punting	
13. 213			128. 22.0		
14. 220 79. 24-0 180, 21-1 180, 21-1 181, 23-1 173, 23-3 181, 23-1 174, 22-3 182, 21-1 174, 22-3 183, 21-0 174, 22-3 183, 23-0 174, 23-1 175, 22-9 213, 22-3 22-0 22-	1				
16. 24-2		78. 23.2	Willow-Warbler	<i>172</i> . 22·9	
16. 21-7			129. 21.3		
17. 210		80. 22.4	130. 21·1	Chaffinch	212. 24.0
18. 20-1 18. 20-1 18. 20-1 18. 20-1 18. 20-1 19. 21-9 Hedge-Sparrow Meadow-Pipit 82. 22-0 182. 23-1 183. 23-0 183. 23-0 184. 23-1 185. 22-9 177. 20-9 217. 22-3 218. 22-5 22-6 24. 20-6 23-2 23-8 23		D 1 D: 11	131. 23.1	173 93.3	
19. 21-9		Rock-Pipit			White-Wagtail
Meadow-Pipit 32. 22-0 32. 23-0 134. 23-1 Goldfinch 216. 22-7 22-2 22-6 35. 23-8 23-6 24. 21-6 36. 25-0 25. 22-2 37. 24-0 24. 21-5 24. 22-2 24. 22-6 24. 22-2 24. 22-6 24. 22-2 24. 22-6 24. 22-7 24. 22-1 24. 22-6 24. 22-7 24. 22-1 24. 22-6 24. 22-7 24. 22-1 24. 22-6 24. 22-7 24. 22-1 24. 22-6 24. 22-7 24. 22-1 24. 22-6 24. 22-7 24. 22-1 24. 22-6 24. 22-7 24. 22-1 24. 22-6 24. 22-7 24. 22-1 24. 22-6 24.		<i>81</i> . 23·9			_
Meadow-Pipit 82 220 133 230 Goldfinch 216 227 222 226 33 239 135 229 177 209 217 223 22 226 35 238 35 238 235 238 235 238 235 238 231 231 231 231 231 232 230 234 232 233 238 232 233 238 232 233 238 233 238 238 231 231 232 230 234 232 233 238 232 233 238 232 230 234 232 233 238 232 233 238 232 233 238 232 233 238 232 233 238 232 233 238 234 232 233 234 236 233 236	I .		Garden-Warbler		
Meadow-Pipit S2. 22'0 134. 23:1 Goldfinch 216. 22.7 22.2 22.6 84. 20:9 135. 22:9 177. 20:9 217. 22:3 218. 22:5 22.2 87. 24:0 Orphean-Warbler 178. 22:7 179. 22:8 22.7 22.2 89. 23:8 138. 21:5 180. 22:1 219. 21:2 22.2 22.3 23.3 140. 22:3 181. 23:4 22.0 22.3 22.2 22.3 23.3 22.5 22.2 23.3 23.2 23.3 22.6 23.2 23.5 23.0 22.6 23.3 22.6 23.3 22.6 23.3 22.2 23.3 22.2 23.3 22.2 23.3 22.2 23.3 22.2 23.3 22.2 23.3 22.2 23.3 22.2 23.3 22.2 23.3 22.2 23.3 22.2 23.3 22.2 23.3 22.2 23.3 22.2 23.3 22.2 23.3 22.2 23.3 22.2 23.3 22.2 23.3 23.2 23.3 23.2 23.3 23	20. 21.9	Hedge-Sparrow	i i	170. 21.2	
21. 21.7	Meadow-Pinit	<i>82</i> . 22·0		Coldenak	
22. 226 85. 238 136. 232 177. 20-9 218. 22-5 218. 22-5 22. 231 22. 24 137. 244 179. 22-8 218. 22-5 218. 22-5 28. 21-7 137. 244 179. 22-8 179. 22-8 219. 21-2 22. 28. 23-1 139. 23-3 180. 22-1 219. 21-2 22. 24 220. 22-4 22. 31 140. 22-3 181. 23-4 220. 22-4 220. 22-4 220. 22-4 220. 22-4 220. 22-4 220. 22-4 221. 22-2 222. 22-2					
## 23. 209				<i>177</i> . 20·9	
24. 216	1	<i>85</i> . 23.8	136. 23.2		218. 22.5
24. 21 o 87. 24 o Orphean-warbler 178. 22 o Blueheaded-Yellow-Wagtai 26. 22 o 88. 21 o 137. 24 o 188. 21 o 179. 22 o Yellow-Wagtai 27. 22 o 39. 23 o 138. 21 o 180. 22 o 22 o 121 o 21 o 21 o 21 o 22 o <t< td=""><td></td><td></td><td>0 1 777 11</td><td>Greenfinch</td><td></td></t<>			0 1 777 11	Greenfinch	
23. 22. 28. 21.7 137. 24.4 179. 22.8 179. 22.8 22.8 22.5 28. 23.8 138. 21.5 130. 22.1 219. 21.2 22.2 22.3 22.3 23.1 140. 22.3 182. 21.2 22.0 22.3 30. 22.6 92. 23.1 31.0 22.3 182. 21.2 22.0 22.3 33. 22.6 92. 23.1 32.5 140. 22.2 33. 22.8 95. 23.0 142. 22.0 34. 22.0 35. 22.4 36. 22.3 37. 22.0 37. 22.3 39. 22.3 39. 22.3 39. 22.3 39. 22.3 39. 22.3 39. 22.3 39. 22.0 35. 22.4 36. 22.3 96. 21.8 144. 21.2 22.3 37. 22.3 39. 22.3 39. 22.3 39. 22.3 39. 22.3 39. 22.3 39. 22.3 39. 22.3 39. 22.3 39. 22.3 39. 22.3 39. 22.4 144. 21.2 21.6 38. 22.1 39. 21.9 99. 22.4 144. 22.0 39. 23.0 39. 23.0 39.			Orphean-Warbler		Blueheaded-
27. 22.2 89. 23.8 138. 21.5 180. 22.1 22.2 22.2 22.2 22.3 3.3 181. 23.4 22.0 22.4 22.0 22.4 22.0 22.4 22.0 22.4 22.0 22.4 22.0 22.2 22.			137. 24.4		
28. 243 99. 228			<i>138</i> . 21·5		l .
29. 22.3 91. 23.1 92. 23.1 92. 23.1 140. 22.3 182. 21.2 183. 22.5 184. 23.9 22.2 22.2 23.3 22.8 95. 23.0 142. 22.0 184. 23.9 22.3 22.3 23.0 22.4 22.2 22.3 23.0 22.4 143. 22.0 100. 22.4 143. 22.0 102. 23.0 22.3 22.0 22.3 22.2 22.2 22.2 22.2 22.2 22.3 23.0 23.0			<i>139</i> . 23·3		
22.5 39. 22.6 39. 23.1 Reed-Warbler 183. 22.5 Yellow-Wagtai 31. 20.1 32. 22.0 34. 22.0 34. 22.0 142. 22.0 143. 22.2 184. 23.9 222. 222. 223. 23.0 224. 22.0 223. 23.0 224. 22.0 223. 23.0 224. 22.0 223. 23.0 224. 22.0 223. 23.0 224. 22.0 224. 22.0 224. 22.0 224. 22.0 224. 22.0 224. 22.0 224. 22.0 224. 22.0 224. 22.0 224. 22.0 224. 22.0 224. 22.0 224. 22.0 224. 22.0 224. 22.0 224. 22.0 224. 22.0 225. 22.0 226. 21.5 227. 20.0 226. 21.0 220. 23.0 220. 23.0 220. 23.0 220. 23.0 220. 23.0 220. 23.0 220. 23.0 220. 23.0 220. 23.0 220. 230. 230. 230. 230. 230. 230. 230.	l e		140. 22.3		220. 224
31. 20·1 93. 23·5 Reed-Warbler 32·2 House-Sparrow 22·1 22·2 22·2 33. 22·0 95. 23·0 14½. 23·2 House-Sparrow 22·2 22·2 22·2 33. 22·0 Robin 14¼. 21·2 Tree-Sparrow 36. 22·3 96. 21·8 145. 21·6 185. 24·0 Wren 37. 20·6 97. 23·0 146. 21·6 185. 24·0 22·3 39. 21·9 99. 22·4 14½. 22·9 186. 22·8 187. 23·2 22·2 22·2 22·3 39. 21·9 100. 22·4 14½. 22·9 186. 22·8 187. 23·2 22·2 22·2 22·3 23·0 44. 22·0 102. 23·0 44. 22·0 102. 23·0 44. 22·0 103. 23·0 45. 19·6 106. 22·0 46. 22·0 106. 22·0 107. 22·6 16. 22·0 16. 22			i i	10%, Z1 Z	
31. 201			Reed-Warbler	183. 22.3	Yellow-Wagtail
32. 220			1	TT Q	_
33. 22.0 Robin 143. 22.2 184. 23.9 223. 23.0 35. 22.4 36. 22.3 96. 21.8 144. 21.2 144. 21.2 145. 21.6 185. 24.0 224. 19.8 37. 20.6 98. 23.3 147. 21.9 148. 22.0 Nightingale 225. 22.1 39. 21.9 99. 22.4 148. 22.0 Nightingale 225. 22.1 40. 23.0 100. 22.4 149. 22.9 186. 22.8 226. 21.5 41. 22.0 102. 23.0 150. 22.8 187. 23.2 227. 20.9 42. 22.0 103. 23.0 Marsh-Warbler 151. 22.7 188. 22.1 231. 21.0 44. 22.0 105. 22.3 166. 22.0 168. 22.8 169. 22.4 44. 22.0 107. 22.6 152. 21.0 189. 22.4 232. 20.3 45. 19.6 105. 22.3 166. 22.0 169. 22.0 169. 22.0 48. 23.4 109. 22.1 123. 153. 22.5 169. 23.0 49. 23.8 110. 21.1 23.0 153. 22.5 169. 23.0 50. 23.3 110. 21.1 23.0 154. 21.9 156. 23.2 191. 22.0 52. 22.3 53. 21.9 54. 22.0 112. 21.3 155. 24.0 191. 22.0 54. 22.0 112. 21.3 156. 23.2 191. 22.0 55. 21.7 113. 19.9 156. 23.2 192. 22.1 193. 20.8 57. 22.2 115. 23.3 157. 22.3 158. 23.0 Sky-Lark Wheatear 159. 23.1 159. 23.1 159. 23.1 59. 22.8 117. 20.9 Reed-Bunting Crested-Lark 241. 24.7 242.7 64. 22.2 120. 22.4 160. 23.2 196. 22.5 242. 240.	<i>32</i> . 22·0	94. 230		House-Sparrow	
Robin 144. 21.2 Tree-Sparrow Wren 35. 22.4 96. 21.8 145. 21.6 185. 24.0 Wren 38. 22.1 99. 22.4 148. 22.0 Nightingale 226. 22.1 226. 21.5 100. 22.4 149. 22.9 186. 22.8 227. 20.9 228. 22.0 102. 23.0 103. 23.0 Marsh-Warbler 151. 22.7 188. 22.1 230. 22.8 22.0 22.3 22.0 22.3 22.0 22.3 22.0 22.3 22.0 22.3 23.0 23.0 23.3 20.9 23.5 20.0 23.5	<i>33</i> . 22·8	99. 230		<i>184</i> . 23 ·9	
36. 22.4 96. 21.8 145. 21.6 17ee-Sparrow Wren 37. 20.6 98. 23.3 146. 21.6 185. 24.0 224. 19.8 38. 22.1 99. 22.4 149. 22.9 Nightingale 225. 22.1 40. 23.0 100. 22.4 149. 22.9 186. 22.8 227. 20.9 41. 22.0 102. 23.0 150. 22.8 187. 23.2 228. 227. 20.9 42. 22.0 102. 23.0 150. 22.8 187. 23.2 228. 22.0 22.2 22.2 22.2 22.2 22.0 150. 22.8 187. 23.2 22.8 22.0 22.2 22.2 22.2 22.2 22.2 22.2 22.2 22.2 22.2 22.2 22.2 22.2 22.2 22.2 22.2 22.2 22.3 22.2 22.3 <td>34. 22.0</td> <td>Robin</td> <td></td> <td>•</td> <td>220. 200</td>	34. 22.0	Robin		•	220. 200
36. 22·3 97. 23·0 146. 21·6 185. 24·0 Wren 37. 20·6 98. 23·3 147. 21·9 Nightingale 224. 19·8 38. 21·9 99. 22·4 148. 22·9 Nightingale 225. 22·1 22. <	<i>35</i> . 22·4			Tree-Sparrow	
37. 20°6 98. 23°3 147. 21°9 Nightingale 224. 19°8 225. 22°1 39. 21°9 100. 22°4 149. 22°9 186. 22°8 22°6. 21°5 22°6. 21°5 40. 23°0 101. 23°0 150. 22°8 187. 23°2 22°7. 20°9 22°8. 22°7. 20°9 41. 22°0 102. 23°0 Marsh-Warbler 151. 22°7 22°8. 22°1. 23°2 22°8. 22°3. 22°3 22°8. 22°3. 23°3. 22°3 22°8. 22°3. 23°3. 22°3 22°8. 22°3. 23°3. 22°3 22°8. 22°3. 23°3. 22°3 22°9. 21°0. 22°3 23°3. 20°9. 22°3. 23°3. 20°9. 22°3 23°3. 20°9. 22°3. 23°3. 20°9. 22°3. 23°3. 20°9. 22°3. 23°3. 20°9. 23°3. 20°	<i>36.</i> 22·3			-	Wren
38. 22·1 99. 22·4 148. 22·0 Nightingale 22.5. 22·1 22.6. 21·5 22·6. 21·5 22·6. 21·5 22·6. 21·5 22·6. 21·5 22·1 22.6. 21·5 22·8 186. 22·8 22.7. 20·9 22.6. 21·5 22·0 10.0. 22·4 149. 22·9 186. 22·8 22.7. 20·9 22·8 187. 23·2 22.7. 20·9 22·8 187. 23·2 22·0 22·2	<i>3</i> 7. 20·6			100. 240	224. 19.8
39. 21-9 40. 23-0 41. 22-0 41. 22-0 42. 22-0 42. 22-0 43. 22-1 44. 22-0 44. 22-0 45. 19-6 46. 22-8 47. 22-0 48. 23-4 49. 23-0 49. 23-8 47. 22-0 49. 23-8 47. 22-0 49. 23-8 46. 22-8 47. 22-0 49. 23-8 46. 22-8 47. 22-0 49. 23-8 46. 22-8 47. 22-0 48. 23-4 49. 23-8 40. 22-8 49. 23-8 40. 22-8 49. 23-8 40. 22-8 49. 23-8 40. 22-8 49. 23-8 50. 23-3 50. 23-3 50. 21-9 54. 22-0 55. 21-7 56. 23-3 57. 21-2 56. 23-3 57. 22-2 115. 23-3 114. 22-9 56. 23-3 57. 22-2 115. 23-3 116. 22-1 59. 22-8 60. 22-9 61. 23-7 62. 22-0 61. 23-7 62. 22-0 63. 21-9 119. 22-9 61. 23-7 62. 22-0 63. 21-9 119. 22-9 61. 23-7 64. 22-2 119. 22-9 61. 23-7 64. 22-2 119. 22-9 61. 23-7 64. 22-2 119. 22-9 63. 21-9 119. 22-9 64. 22-2 119. 22-9 65. 21-9 66. 22-9 67. 20-2 118. 21-9 119. 22-9 110. 22-9 110. 23-0 110. 21-1 110. 2	<i>38</i> . 22·1			Nightingala	225 22.1
40. 23-0	<i>39</i> . 21·9				
101. 23.0	<i>40</i> . 23 ·0				
42. 22·0 102. 23·0 Marsh-Warbler 22·9 21·0 23·0 22·3 22·1 104. 23·9 151. 22·7 188. 22·1 230. 22·3 23·0 23·0 23·0 23·0 23·0 22·3 23·1. 21·0 23·1. 21·0 23·2. 23·2. 23·2. 23·3. 20·9 23·3. 20·9 23·3. 20·9 23·3. 20·9 23·3. 20·9 23·3. 20·9 23·3. 20·9 23·6. 20·8 23·6. 20·8 23·6. 20·8 23·6. 20·8 23·6. 20·8 23·6. 20·8 23·6. 20·8 23·7. 21·0 23·6. 20·8 23·7. 21·2 23·6. 20·8 23·7. 21·2 23·6. 20·8 23·7. 21·2 23·6. 20·8 23·7. 21·2 23·8. 21·0 23·1. 22·0 23·1. 22·2 22·1. 23·2 23·1. 22·2 23·1. 23·2 23·1.			150. 22.8	187. 23·2	
103. 23.9			36 3 377 33		4
44. 22·0 105. 22·3 151. 22·7 188. 22·1 231. 21·0 45. 19·6 106. 22·0 Lesser-Whitethroat 189. 22·4 232. 20·3 47. 22·0 107. 22·6 152. 21·0 Lesser-Grey-Shrike 233. 20·9 48. 23·4 108. 22·0 153. 22·5 190. 23·0 234. 22·0 50. 23·3 110. 21·1 Barred-Warbler 154. 21·9 Woodchat-Shrike 237. 21·2 52. 22·3 Blackcap Red-Start 155. 24·0 192. 22·1 193. 20·8 54. 22·0 112. 21·3 156. 23·2 157. 22·3 158. 23·0 Red-backed-Shrike 192. 22·1 193. 20·8 57. 22·2 115. 23·3 158. 23·0 Sky-Lark Wheatear 59. 22·8 117. 20·9 Saxicola-Melanoleuca 194. 22·2 240. 22·8 60. 22·9 118. 21·9 Reed-Bunting Crested-Lark 241. 24·7 62. 22·0 118. 21·9 Reed-Bunting Crested-Lark 241. 24·7 64. 22·2 120. 22·4 160. 23·2 196. 22·5 242. 24·0				Spotted-Flycatcher	
45. 19·6			151. 22.7		
46. 22·8 107. 22·6 107. 22·6 107. 22·6 107. 22·6 107. 22·6 107. 22·6 107. 22·6 107. 22·6 107. 22·6 107. 22·6 107. 22·6 107. 22·6 108. 22·0 118. 22·0 119. 22·1 153. 22·5 190. 23·0 234. 22·0 235. 20·0 236. 20·0 236. 20·0 236. 20·0 236. 20·0 236. 20·0 236. 20·0 236. 20·0 236. 20·0 236. 20·0 236. 20·0 236. 20·0 236. 20·0 236. 20·0 237. 21·2 238. 21·0 23·1 191. 22·0 238. 21·0 23·1 191. 22·0 191. 22·0 192. 22·1 193. 20·8 192. 22·1 193. 20·8 193. 22·2 239. 24·2					
47. 22·0 107. 22·6 152. 21·0 Lesser-Grey-Shrike 234. 22·0 23·3. 22·1 153. 22·5 190. 23·0 23·5. 20·0 236. 20·8 237. 21·2 23·6. 20·8 237. 21·2 236. 20·8 237. 21·2 23·6. 20·8 237. 21·2 238. 21·0 23·6. 20·8 237. 21·2 238. 21·0 23·6. 20·8 237. 21·2 238. 21·0 23·1 19. 22·0 23·8. 21·0 23·2 19. 22·0 11. 23·2 15. 23·2 19. 22·1 193. 20·8 23·9. 24·2 23·9. 24·2 23·9. 24·2 23·9. 24·2 23·9. 24·2 23·9. 24·2 23·9. 24·2 23·9. 24·2 23·9. 24·2 23·9. 24·2 24·9. 23·9. 24·2 24·9. 23·9. 24·2 24·9. 23·9.			Lesser-Whitethroat	189. 22.4	
48. 23·4 108. 22·1 153. 22·5 190. 23·0 236. 20·8 50. 23·3 110. 21·1 Barred-Warbler 154. 21·9 Woodchat-Shrike 235. 20·0 52. 22·3 Blackcap Red-Start 191. 22·0 38. 21·0 54. 22·0 112. 21·3 155. 24·0 Red-backed-Shrike Wren 55. 21·7 113. 19·9 156. 23·2 192. 22·1 193. 20·8 57. 22·2 115. 23·3 157. 22·3 158. 23·0 Sky-Lark Wheatear 59. 22·8 117. 20·9 Saxicola-Melanoleuca 194. 22·2 240. 22·8 60. 22·9 118. 21·9 Reed-Bunting Crested-Lark 241. 24·7 64. 22·2 120. 22·4 160. 23·2 196. 22·5 24/2. 24·0			1	T (1. (1. '1	
49. 23·8 109. 22·1 110. 21·1 110. 21·1 111. 23·0 Barred-Warbler 154. 21·9 Woodchat-Shrike 237. 21·2 238. 21·0 52. 22·3 Blackcap 112. 21·3 Red-Start 191. 22·0 Fire-Crested-Wren 55. 21·7 113. 19·9 155. 24·0 192. 22·1 193. 20·8 Fire-Crested-Wren 56. 23·3 114. 22·9 156. 23·2 192. 22·1 193. 20·8 23·9 24·2 57. 22·2 115. 23·3 157. 22·3 158. 23·0 Sky-Lark Wheatear 59. 22·8 117. 20·9 Saxicola-Melanoleuca 194. 22·2 240. 22·8 60. 22·9 118. 21·9 Reed-Bunting Crested-Lark 241. 24·7 62. 22·0 118. 21·9 Reed-Bunting Crested-Lark 241. 24·7 64. 22·2 120. 22·4 160. 23·2 196. 22·5 24·2. 24·0				Lesser-Grey-Shrike	
110. 21·1		109. 22.1	100. 220	190. 23 ·0	000 000
51. 22·5 111. 23·0 154. 21·9 Woodchat-Shrike 238. 21·0 52. 22·3 Blackcap Red-Start 191. 22·0 Fire-Crested-Wren 54. 22·0 113. 19·9 155. 24·0 192. 22·1 192. 22·1 23·9. 24·2 56. 23·3 114. 22·9 156. 23·2 193. 20·8 23·9. 24·2 58. 22·3 116. 22·1 158. 23·0 Sky-Lark Wheatear 59. 22·8 117. 20·9 Saxicola-Melanoleuca 194. 22·2 240. 22·8 60. 22·9 118. 21·9 Reed-Bunting Crested-Lark 241. 24·7. 62. 22·2 120. 22·4 160. 23·2 196. 22·5 242. 240.			Damed Warbler		
51. 22 3 52. 22 3 53. 21 9 54. 22 0 55. 21 7 56. 23 3 57. 22 2 57. 22 2 58. 22 3 58. 22 3 58. 22 3 59. 22 8 60. 22 9 60. 22 9 61. 23 7 62. 22 0 63. 21 9 63. 21 9 64. 22 2 64. 22 2 65. 22 3 66. 22 2 66.		<i>111.</i> 23 ·0	1	Woodchat-Shrike	
53. 21·9 Blackcap Red-Start Red-Start Red-backed-Shrike Fire-Crested-Wren 55. 21·7 113. 19·9 155. 24·0 192. 22·1 Wren 56. 23·3 114. 22·9 156. 23·2 193. 20·8 23·9. 24·2 57. 22·2 116. 22·1 158. 23·0 Sky-Lark Wheatear 59. 22·8 117. 20·9 Saxicola-Melanoleuca 194. 22·2 240. 22·8 61. 23·7 Whitethroat 159. 23·1 195. 21·2 Linnet 62. 22·0 118. 21·9 Reed-Bunting Crested-Lark 241. 24·7 64. 22·2 120. 22·4 160. 23·2 196. 22·5 242. 240.			154. 21.9		238. 210
53. 21.7 112. 21.3 Red-Start Red-Start 155. 24.0 Red-backed-Shrike Wren 55. 21.7 113. 19.9 156. 23.2 192. 22.1 23.0 22.1 193. 20.8 22.1 239. 24.2 57. 22.2 116. 22.1 158. 23.0 Sky-Lark Wheatear 59. 22.8 117. 20.9 Saxicola-Melanoleuca 194. 22.2 240. 22.8 60. 22.9 Whitethroat 159. 23.1 195. 21.2 Linnet 62. 22.0 118. 21.9 Reed-Bunting Crested-Lark 241. 247. 64. 22.2 120. 22.4 160. 23.2 196. 22.5 242. 240.		Blackcap	_	191. ZZ'U	
54. 22 0 113. 19 9 155. 24 0 Red-backed-Shrike Wren 55. 21 7 113. 19 9 156. 23 2 192. 22 1 22 1 56. 23 3 114. 22 9 157. 22 3 157. 22 3 193. 20 8 23 9. 24 2 58. 22 3 116. 22 1 158. 23 0 Sky-Lark Wheatear 59. 22 8 117. 20 9 Saxicola-Melanoleuca 194. 22 2 240. 22 8 60. 22 9 118. 21 9 159. 23 1 195. 21 2 Linnet 63. 21 9 119. 22 9 Reed-Bunting Crested-Lark 241. 24 7 64. 22 2 120. 22 4 160. 23 2 196. 22 5 242. 24 0		ı -	Red-Start	Dad hadrad Class	Fire-Crested-
56. 23·3			155. 24.0		
50. 23.5 115. 23.3 157. 22.3 193. 20.8 23. 24.2 58. 22.3 116. 22.1 158. 23.0 Sky-Lark Wheatear 59. 22.8 117. 20.9 Saxicola-Melanoleuca 194. 22.2 240. 22.8 61. 23.7 Whitethroat 159. 23.1 195. 21.2 Linnet 62. 22.0 118. 21.9 Reed-Bunting Crested-Lark 241. 247. 64. 22.2 120. 22.4 160. 23.2 196. 22.5 242. 240.				<i>192</i> . 22 ·1	
57. 22.2 116. 22.1 58. 22.3 116. 22.1 59. 22.8 117. 20.9 60. 22.9 Saxicola-Melanoleuca 61. 23.7 Whitethroat 62. 22.0 118. 21.9 63. 21.9 119. 22.9 64. 22.2 120. 22.4 160. 23.2 196. 22.5 241. 24.7 242. 24.0				<i>193</i> . 20 ·8	z39. 24'2
58. 22.8 59. 22.8 117. 20.9 Saxicola-Melanoleuca 194. 22.2 240. 22.8 61. 23.7 Whitethroat 62. 22.0 118. 21.9 63. 21.9 119. 22.9 Reed-Bunting Crested-Lark 241. 24.7 64. 22.2 120. 22.4 160. 23.2 196. 22.5 242. 24.0					
69. 22.8 60. 22.9 61. 23.7 62. 22.0 63. 21.9 64. 22.2 120. 22.4 159. 23.1 194. 22.2 21.2 240. 22.8 159. 23.1 195. 21.2 Linnet 241. 24.7 242. 240. 241. 24.7 242. 240.	1		100. 200	Sky-Lark	Wheatear
60. 22.9 61. 23.7 Whitethroat 159. 23.1 195. 21.2 62. 22.0 118. 21.9 63. 21.9 119. 22.9 Reed-Bunting Crested-Lark 241. 24.7 64. 22.2 120. 22.4 160. 23.2 196. 22.5 242. 24.0		117. 20.9	Saricola-Malanolana	•	240 99.8
62. 22·0		3371			~40. 44 U
63. 21·9 119. 22·9 Reed-Bunting Crested-Lark 241. 24·7 64. 22·2 120. 22·4 160. 23·2 196. 22·5 242. 24·0			159. 23.1	195. 21.2	T
63. 21.9 119. 22.9 Reed-Bunting Crested-Lark 241. 24.7 64. 22.2 120. 22.4 160. 23.2 196. 22.5 242. 24.0	<i>62.</i> 22·0	<i>118</i> . 21.9	n 15	0 -1 17 1	Linnet
64. 22.2 120. 22.4 160. 23.2 196. 22.5 242. 24.0	<i>63</i> . 21.9	119. 22.9	Keed-Bunting	Crested-Lark	241. 24·7
ا المانية الأما	64. 22.2	120. 22.4	160. 23.2	196. 22·5	
, , , , , , , , , , , , , , , , , , , ,	65. 24.4				
		<u> </u>			·

APPENDIX II. Cuckoo (C. canorus). Breadth of Egg in millimetres.

	T	,		
Clutch Unknown	Tree-Pipit	Chiffchaff	Yellow-Ammer	Pied-Wagtail
1. 17·0	66. 16·3	122. 15·3	<i>162</i> . 16·0	198. 16· 3
2. 14·9	67. 16·6		<i>163</i> . 16·0	199. 16.7
<i>3</i> . 16 [.] 0	<i>68</i> . 17·0	Sedge-Warbler	<i>164</i> . 16·1	<i>200</i> . 17·0
<i>4</i> . 17·4	<i>69</i> . 16·9	<i>123</i> . 16·0	<i>165</i> . 17· 2	<i>201</i> . 16·3
<i>5</i> . 17·4	70. 16·3	<i>124</i> . 16·1	<i>166</i> . 16·5	<i>202</i> . 16·7
6. 16·5	<i>71</i> . 16·7	<i>125</i> . 16·3	<i>167</i> . 17·0	<i>203</i> . 16·5
7. 17.2	72. 16·5	126. 16·5	<i>168</i> . 17·0	<i>204</i> . 16·0
8. 17.2	73. 16·2		<i>169</i> . 17·0	<i>205</i> . 16·0
9. 180	74. 16.3	Wood-Warbler	<i>170</i> . 16·8	206. 16·8
10. 17.8	75. 16·7	<i>127</i> . 16·2	G D 11	207. 15.8
11. 18·0 12. 15·0	76. 17·5	128. 15·2	Corn-Bunting	208. 16.2
12. 15·0 13. 16·0	77. 17·3 78. 16·4		<i>171</i> . 15·8	209. 17·1 210. 16·0
14. 16·5	79. 17.3	Willow-Warbler	<i>172</i> . 17·0	210. 100 211. 16·9
15. 17·3	80. 16·0	<i>129</i> . 15·8		212. 17·2
16. 16·9	80. 100	130. 15·8	Chaffinch	212. 112
17. 16·1	Rock-Pipit	131. 16·6	<i>173</i> . 16·1	White We at all
18. 15·8	<i>81</i> . 16·4	<i>132</i> . 16·0	<i>174</i> . 16·2	White-Wagtail
19. 15.9	į		<i>175</i> . 17 ·3	<i>213</i> . 16·8
20. 16·2	Hedge-Sparrow	Garden-Warbler	<i>176</i> . 15·7	214. 17.0
Meadow-Pipit	<i>82</i> . 17·0	<i>133</i> . 16·2		<i>215</i> . 17·0
	<i>83</i> . 16·9	<i>134.</i> 16·8	Goldfinch	<i>216</i> . 16·9
<i>21</i> . 16·1 <i>22</i> . 17·0	<i>84</i> . 15·8	135. 160	<i>177</i> . 16·0	<i>217</i> . 17·3
<i>22.</i> 17∙0 <i>23.</i> 16·2	85. 17·3	136. 17.0		<i>218</i> . 16·9
23. 16·2 24. 16·2	86. 17·5	Ombo 1171-1	Greenfinch	
25. 16·9	87. 17.5	Orphean-Warbler	<i>178</i> . 14·5	Blueheaded-
<i>26</i> . 16·9	88. 16.2	<i>137</i> . 17·9	179. 16·7	Yellow-Wagtail
27. 17.3	89. 16·5	<i>138</i> . 16·0	180. 16·9	<i>219</i> . 15·9
28. 16·8	90. 16·2 91. 17·1	139. 16.4	<i>181</i> . 17·0	<i>220</i> . 17·2
<i>29</i> . 16·8	92. 16·1	140. 16·3	182. 16·2	
<i>30</i> . 17·0	93. 16·9	Reed-Warbler	<i>183</i> . 17·0	Yellow-Wagtail
<i>31</i> . 16·5	94. 16.7	,		
<i>32</i> . 16·9	95. 17.0	141. 16.9	House-Sparrow	<i>221</i> . 16·7 <i>222</i> . 16·4
<i>33</i> . 16·5	100. 11.0	142. 17.1	<i>184</i> . 17·7	223. 16·3
34. 17·0	Robin	143. 17·0 144. 16·1	234.	220. 100
<i>35</i> . 17·0	<i>96</i> . 16·0	145. 16·5	Tree-Sparrow	337
<i>36</i> . 16·3	97. 15.9	146. 16.5	<i>185</i> . 16·0	Wren
<i>37</i> . 16·2	98. 17.1	147. 16.1	100. 100	<i>224</i> . 15·0
38. 16·8 39. 17·0	<i>99</i> . 16 [.] 6	148. 16.5	Nightingale	<i>225</i> . 16·0
39. 17·0 40. 16·9	<i>100</i> . 16·9	149. 17·9	T	226. 16·2
41. 17.0	<i>101</i> . 16·1	<i>150</i> . 16·5	<i>186</i> . 17·2 <i>187</i> . 16·0	227. 15.7
42. 17·0	<i>102</i> . 17·2		187. 100	228. 16.2
43. 17·3	<i>103</i> . 16·2	Marsh-Warbler	Spotted-Flycatcher	229. 15·5 230. 16·0
44. 16.8	104. 16.9	<i>151</i> . 16·7	-	231. 15·9
45. 15·8	105. 15.2		188. 15·8	232. 15·5
46. 17.1	106. 16.3	Lesser-Whitethroat	<i>189</i> . 16·5	233, 15·9
<i>47</i> . 16·9	107. 17.0	<i>152</i> . 16·0	Lesser-Grey-Shrike	234. 16·0
48. 16·4	108, 16.0	153. 16·2	~	235. 15·7
49. 16·4	109. 16·4 110. 16·4		<i>190</i> . 16·8	236. 15·9
<i>50</i> . 16·8	110. 104 111. 17·0	Barred-Warbler	177 - John & Cl	<i>23</i> 7. 16·0
<i>51</i> . 17·1	111. 110	<i>154</i> . 16·8	Woodchat-Shrike	<i>238</i> . 16·0
<i>52</i> . 17·0	Blackcap		<i>191</i> . 17·0	1
<i>53</i> . 17·1	1 -	Red-Start		Fire-Crested-
54. 17.2	112. 16·1 113. 16·0	155. 17·7	Red-backed-Shrike	Wren
55. 16·2	113. 16·0 114. 16·0	156. 16·2	<i>192</i> . 17·1	<i>239</i> . 16·9
56. 16.7	115. 16·1	157. 16.7	193. 15·7	200. 100
57. 16·8 58. 16·2	116. 17·8	<i>158</i> . 17·0		Wheeter
58. 16·2 59. 16·4	117. 15·3		Sky-Lark	Wheatear
60. 17·2		Saxicola-Melanoleuca	<i>194</i> . 18·1	<i>240</i> . 16·6
61. 17·0	Whitethroat	<i>159</i> . 17·1	195. 15·6	
62. 17·2	118. 17·0			Linnet
63. 17·0	119. 16.4	Reed-Bunting	Crested-Lark	<i>241</i> . 16·3
64. 16.2	120. 16·6	160. 16.9	196. 16.4	242. 18·8
65. 16·2	121. 140	161. 15.9	197. 15·9	243. 17·1
	L	I		L

APPENDIX III.

Frequency Distribution of Cuckoo's Eggs.

Length	Number	Breadth	Number
18·75—19·25 19·25—19·75 19·75—20·25 20·25—20·75 20·75—21·25 21·25—21·75 21·75—22·25 22·25—22·75 22·75—23·25 23·25—23·75 23·75—24·25 24·25—24·75 24·75—25·25	1 7 3 29 13 54 38 47 22 21 5	$\begin{array}{c} 13.75 - 14.25 \\ 14.25 - 14.75 \\ 14.75 - 15.25 \\ 15.25 - 15.75 \\ 15.75 - 16.25 \\ 16.25 - 16.75 \\ 16.75 - 17.25 \\ 17.25 - 17.75 \\ 17.75 - 18.25 \\ 18.25 - 18.75 \\ 18.75 - 19.25 \\ \end{array}$	1 1 5 9 73 51 80 15 7 0
	243		243

These distributions are fitted with normal curves in the accompanying diagrams.

Length

$$y = 45.793 e^{-\frac{1}{2}x^2/(2.117)^2}$$
.

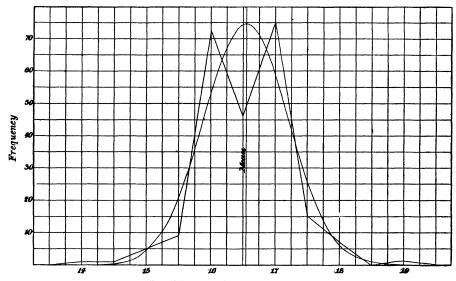
Origin at 22.40.

Breadth

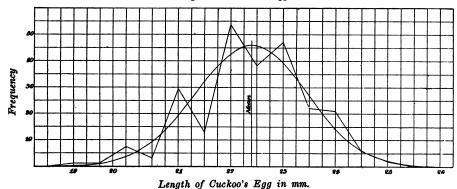
$$y = 74.618 e^{-\frac{1}{2}x^2/(1.2992)^2}.$$

Origin at 16:54.

Breadth of Cuckoo's Egg.







The curves give fairly reasonable graduated values, considering: (i) the paucity of data, and (ii) the possibility of class differences within the race indicated in this memoir.

APPENDIX IV.

Table of Egg Measurements.

The following is a summary of my measurements on the Cuckoo's and other birds' eggs. I have added the results of recent measurements on the eggs of House-Sparrow, Blackbird, Song-Thrush, Starling and Linnet made by Professor Pearson and some of his co-workers. The whole serves to illustrate the relative smallness of the Cuckoo's egg.

Bird	Approxi- No. of		LENGTH OF EGG			Breadth of Egg		
	mate length in inches	Cases	Mean	S. D.	C. of V.	Mean	S. D.	C. of V.
Cuckoo Blackbird Song-Thrush Starling Wagtail* Yellow-Ammer Tree-Pipit Meadow-Pipit House-Sparrow Hedge-Sparrow Robin Linnet	14 10 9 8—8·5 7—8 7 6·5 6 6 6 5·5—6	243 114 151 27 16 32 27 74 687 26 57	22·40 29·44 27·44 29·78 20·75 21·55 20·01 19·72 21·82 20·12 20·22 17·14	1·0585 1·3568 ·9988 1·0973 1·4448 ·6821 ·6978 1·2504 1·1946 ·8096 ·8565 ·5984	4·72 4·61 3·64 3·68 6·96 3·17 3·49 6·37 5·47 4·02 4·24 3·49	16·54 21·73 20·69 21·76 14·67 16·04 15·09 14·56 15·51 14·73 15·43 13·33	·6496 ·7874 ·5162 ·4233 ·3703 ·4045 ·4488 ·5611 ·5245 ·4146 ·4771 ·3581	3·93 3·62 2·50 1·94 2·52 2·53 2·97 3·84 3·38 2·81 3·09 2·69

^{*} This was a mixed series made up of 6 eggs of White-Wagtail, 7 of Pied-Wagtail and 3 of Blueheaded-Yellow-Wagtail. This accounts for the great variability in length. We see that the Cuckoo's egg is the most variable of the whole series in breadth and with the exception of the Meadow-Pipit's and House-Sparrow's the most variable also in length. The biggest of all the birds here dealt with, the Cuckoo has an egg hardly longer than the House-Sparrow's or broader than the Yellow-Ammer's.