joining, the upper part of the valve being solid and projecting freely, while the carina of *S. fossula* has the intraparietes forming a thin wall on each side of the carina, which is a more advanced type. There is not as yet sufficient evidence to prove whether *S. fossula* was derived from *S. arcuatum* or not. It is patent, however, that from the foregoing species subsequently arose the forms grouped as *Arcoscalpellum* and characterized by a reduction in the number of plates of the capitulum, by a suppression of the rostrum, and a tendency towards the reduction of the pair of infra-median latera.

For help in connexion with this paper I wish to express my indebtedness to Dr. F. A. Bather, Dr. W. T. Calman, Mr. C. P. Chatwin, and Dr. P. P. C. Hoek.

Key to Species mentioned.

A. Carina without intraparietes, parietes not reaching to the basal margin and bent almost at right angles to the tectum	*S. simplex* Darwin.
B. Carina with intraparietes bent inwards and joining, the upper part of the valve solid and projecting freely.	
1. Carina with basal margin rounded	*S. accumulatum* Withers.
2. Carina with tectum flatly-arched transversely, and marked with numerous fine longitudinal ridges	*S. arcuatum* Darwin.
3. Carina with tectum flatly-arched transversely, and marked with three prominent longitudinal ridges, one central, and one on either side separating the tectum from the parietes	*S. trilineatum* Darwin.
4. Carina with tectum strongly convex transversely and marked with several longitudinal ridges	*S. solidulum* Steenstrup sp.
5. Carina with tectum strongly convex transversely with smooth surface	*S. maximum* var. *cylindraceum* Darwin.
C. Carina with intraparietes forming a thin wall on each side of the valve.	
1. Carina with tectum and parietes smooth, dorsal surface and inner margin much arcuated	*S. hastatum* Darwin.
2. Carina with tectum bordered on each side by a large, protuberant, flat-topped ridge	*S. fossula* Darwin.

28. Experimental Pheasant-breeding.

By Rose Haig Thomas, F.Z.S.

[Received December 4, 1911; Read February 6, 1912.]

(Plates LXIV.–LXVII.*)

The experiment with which I deal in this paper was undertaken to test the truth of the result of one previously made (P. Z. S. 1909, pp. 884–885), in which it was shown that a male Pheasant had transmitted to his female offspring of the second

* For explanation of the Plates see p. 545.

generation the female plumage of his species, under the following scheme of mating :—

Silver ♀ × Swinhoe ♂

F. 1 ♀ × Swinhoe ♂

(1) F. 2 ♀ Sw. (1) ♂ Sw. (3) ♂ Sw. hyb.

It is to be observed that the Swinhoe male transmitted the pure Swinhoe plumage only to one of his male offspring. As such an isolated instance, though interesting, had small value without the support of other evidence, the following experiment was arranged. I chose species which have mature plumage in five months from hatching, so as to get quicker at the results, instead of, as in the case of *gennæus*, waiting eighteen months for the adult plumage of F. 2. *Phasianus formosus*, one of the species selected, is found only on the Island of Formosa ; somewhat resembling *P. torquatus*, it differs from it in one special feature ; in the cock, the collar, instead of being an even white ring forming a complete circle round the neck, is formed by a deep Vandyke on each side with a narrow connecting-line round the back of the neck but not connected round the throat, an incomplete circle. The other species, *P. versicolor*, the Japanese Pheasant, is too well known to require description ; it has no white collar.

Below is appended a table of the differences between the males and females of the two species which might be expected to prove Mendelian pairs.

P. formosus ♂.

Moult: Rapid, early.
Leg:
Colour: Pale bluish grey.
Dimension: Thick.
Bill: Large.
Crest: Pale.
Breast: Rich brown.
Tail: Long.
All rectrices banded.
Neck: White collar.
Bird: Large.

P. versicolor ♂.

Moult: Slow, late.
Leg:
Colour: Dark, reddish grey.
Dimension: Thin.
Bill: Small.
Crest: Dark.
Breast: Metallic green.
Tail: Short.
Some laterals not banded.
Neck: White collar absent.
Bird: Small.

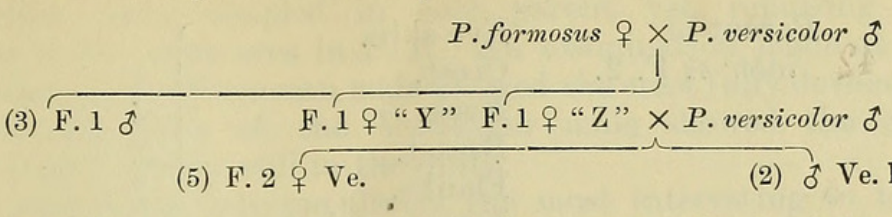
P. formosus ♀.

Leg:
Colour: Pale bluish grey.
Dimension: Thick.
Bill: Large.
Colour: Greyish green, paler at gape.
Crest: Pale ground, black oval spots.
Breast: Pale buff, no pattern.
Tail: Banded pattern on pale ground.
Bird: Large.
Egg: Large.
Calm temperament: quiet, tame.

P. versicolor ♀.

Leg:
Colour: Reddish grey.
Dimension: Thin.
Bill: Small.
Colour: Darker greyish green, same all over.
Crest: Dark ground, irregular black patches.
Breast: Dark buff, thickly patterned.
Tail: Banded pattern on dark ground.
Bird: Small.
Egg: Small.
Excitable temperament: wild, untameable.

Scheme of mating in second experiment :—



The second experiment confirmed the results obtained in the first.

Four skins of the F. 2 ♀'s are exhibited (the fifth female has been kept to breed from), together with skins of pure Versicolor and pure Formosan females, also the skin of the F. 1 ♀ "Z" parent of F. 2. If these are all turned breast uppermost, it is seen at a glance that Versicolor pattern and coloration are present to a certain extent in F. 1 ♀ "Z," mother of the F. 2 generation, and that the F. 2 females appear to be identical with Versicolor in size, pattern, and coloration, except for small differences which might be found existing between individuals of any species. Besides plumage, these five hens had the habit and temperament of the Versicolor, the leg-colour and eye-skin also.

The records of this experiment constantly refer to the quick sharp movements, the wild scared appearance of the F. 2 females, so characteristic of the habits and ways of the untameable Versicolor. If the pen was entered for any purpose, even when exercising the greatest care, there was always a chance the birds might break their necks in their terrified flights and violent dashes against the wire netting, and in this manner one or two were scalped to the bone.

A list of the Versicolor characters found in the F. 1 females is interesting, for there are certain characters which can only be classified in the living bird: Leg-colour, eye-skin, bill, moult, habit, temperament, voice.

F. 1 ♀ "Z" (*P. formosus* ♀ × *P. versicolor* ♂).

Parent of F. 2 (Fo. × Ve. × Ve.).	Eye-skin.	*Versicolor.*
	Crest.	
	Neck.	
	Flank.	
	Breast.	
	Interscapulars.	
	Scapulars.	
	Secondaries.	
	Back.	
	Size of egg.	
	Tail	*Formosan.*
	Bill.	*Hybrid.*
	Primaries.	
	Dimension.	
	Leg.	

F. 1 ♀ "Y."

Parent of *inter se* F. 2.	Eye-skin.	*Versicolor.*
	Crest.	
	Neck.	
	Breast.	
	Flanks.	
	Interscapulars.	
	Scapulars.	
	Secondaries.	
	Back.	
	Size of egg.	
	Leg	*Formosan.*
	Bill.	*Hybrid.*
	Primaries.	
	Dimension.	
	Tail.	

In both F. 1 females the size of egg was transmitted by the Versicolor male.

5 F. 2 ♀.	Crest.	*Versicolor.*
	Neck.	
	Flank.	
	Breast.	
	Legs.	
	Bill, size and colour.	
	Interscapulars.	
	Scapulars.	
	Secondaries.	
	Primaries.	
	Tail.	
	Back.	
	Dimension.	
	Habit of moult.	
	Temperament.	

The fifth female, reserved to breed from, has a pale grey stripe down the back of the shank of one leg.

The presence of a mosaic of pale grey and dark grey seen in the legs of F. 1 in this experiment led to the inference that the two parents had severally pale grey legs and dark grey legs, which an immediate examination of the Formosan and Versicolor species confirmed. A curious independent double segregation of allelomorphs was observed in the autumn of 1911 in the crests of the F. 1 males. The centre feathers were dark—colour Versicolor; fully developed, rapid early moult—habit Formosan: the feathers on the outer edge of the crest were pale—colour Formosan;

undeveloped, many still in the quill—habit Versicolor: two Mendelian pairs coupled in each parent yet repulsing one another in the same area in F. 1. An examination made at the same time of the Formosan male showed the crest fully developed, and an inspection of the Versicolor male showed the crest undeveloped, mostly still in the quill.

F. 1 generation is to me always the most interesting in these artificial Pheasant crosses. For Mendelian segregation already shows, and it is sometimes possible to select the strain of parentage desired to reappear more strongly in the F. 2 generation. Also F. 1 occasionally produces remarkable mosaics of sex—a sort of sex-hybridism accompanied by sterility and extraordinary developments of plumage in the female, phenomena I will not touch upon now. To illustrate more clearly the points I wish to bring to your notice, here is a selection of secondaries (3rds from the last primary) extracted from the wings of the parent species and of all the birds connected with the experiment (Pl. LXIV.): the Formosan male secondaries have a peculiar Vandyke pattern like a feather laid on a feather, and the female secondaries of this species are banded, both are extremely light in colour. The Versicolor male secondaries have a mottled grey oblique banding on a very dark grey ground; the female secondaries of this species are rich brown, with wide bands of darker brown; also placed in the same frame are the secondaries of F. 1 and F. 2 males and females. After examining the parents' secondaries, we perceive that the Versicolor male has transmitted to his female offspring of the F. 1 generation the female secondaries of his species, and that conversely the Formosan female has transmitted to her male offspring of the F. 1 generation a pattern resembling the male secondaries of her species on one vane, though not on the other vane of the feather. In the F. 2 generation ("Fo × Ve. × Ve." Pl. LXV.) the influence of the Versicolor male on his female offspring continues in pattern and size and more or less in colour, for in F. 2 females the secondaries seem to be Versicolor, with slight differences of colour not unlikely to be found between individuals of the same species; whilst the F. 2 male secondaries, though most resembling Versicolor, are somewhat hybrid in size and pattern, and still show slight traces of Formosan influence.

A selection of interscapulars extracted from the parents and from the two generations of the Formosan Versicolor cross is shown; the females are in one frame, the males in another, and in these the same phenomena appear. Those of the F. 1 females seem to be Versicolor in pattern and colour, as also do the five F. 2 females, with certain modifications that might be readily found amongst individuals of a pure race (Pl. LXVI.). The frame containing the male interscapulars shows amongst the F. 1 males a Formosan and also a hybrid pattern, whilst the F. 2 males are also hybrid (Pl. LXVII.).

The phenomenon of pattern-transference has occurred in all my Pheasant crosses; sometimes from the male to the female, or

conversely from the female to the male, or a pattern may be transferred from one area in the parent species to another area in the F. 2 offspring. I have noticed that these pattern-transferences are inclined to remain fixed and constant.

Colour-transference also takes place, and sometimes where it has occurred seemed to inhibit the appearance of pattern.

One instance was noticed where the breasts of the males of the two races crossed, *Th. amhersti* and *Th. picta*, differing widely in colour, both colours were found on the breast of F. 2 *Th. obscura*, the red of *picta* overlying the metallic green of *amhersti*.

These appear to be the results of the second experiment:—

(1) The male parent transmitted to his F. 1 female offspring much of the female plumage of his species and the dimension of the egg.

(2) The female parent transmitted to her F. 1 male offspring much of the male plumage of her species.

(3) In the F. 2 generation, the offspring of F. 1 female × Versicolor male, the Versicolor male seems to have transmitted every character—bill, leg-colour, plumage, habit, and temperament—of the female of his species to his F. 2 female offspring, whilst he has not transmitted every character of the male of his species to his F. 2 male offspring; repeating exactly the results of the original experiment with *gennæus*.

Are we, then, to suppose that some of the gametes of this Versicolor male contained all the factors representing the temperament and habit, the colour, pattern, and dimension of plumage, leg, and bill, and the bulk of the female of his species and even the factor for size of egg, with the one exception of the factor for the sex to which these belonged?

To the practical experimentalist, to the non-mathematical simple observer, the hypothesis is difficult to conceive.

These phenomena seem to be of the nature of a sex-limitation opposed to expectation.

I have read with much interest Mr. Doncaster's account of gametogenesis in the Gall-fly, also his researches on sex-limitations published in 'Genetics,' and am interested to know how he would consider the above facts in relation to his theory of sex: Male gametes ♂ O female gametes ♂ ♀ with selective fertilisation between the male gamete O (a non-determinant of sex) and the female gamete ♂.

I hope the material collected in these two experiments may be thought of sufficient importance for the higher students of Genetics to give it some attention, when probably the apparently complicated problem will receive a simple explanation.

EXPLANATION OF THE PLATES.

Plate LXIV.

♂ & ♀ Secondaries (3rd from primary) of the two Parent species and of F. 1 (Fo.×Ve.).

1. *P. versicolor* ♀. Horizontally set, broad bands, bifurcated ends; ground-colour brown.
2. *P. versicolor* ♂. Mottled light bands V-shaped, apex towards rachis; ground-colour dark grey.
3. *P. formosus* ♀. Obliquely set narrow bands, pointed ends; ground-colour nearly white.
4. *P. formosus* ♂. Vandyke pattern, light, mottled; ground-colour light grey.
5. F. 1 ♀ "Z" (*P. form.* ♀ × *P. vers.* ♂). (Parent of F. 2, Fo.×Ve.×Ve.). Colour, banding, length of feather, *versicolor*; a similar mottling to that here seen is found on the 3rd Secondaries of a pure *versicolor* ♀ unrelated now living in my pheasantry.
6. F. 1 ♂ "C" (*P. form.* ♀ × *P. vers.* ♂). Left vane Vandyke, Formosan ♂ pattern. Right vane hybrid banding. Colour hybrid.

Plate LXV.

♂ & ♀ Secondaries (3rd from primary) of F. 2 (Fo.×Ve.×Ve.).

1. F. 2 ♂ "G" (F. 1 Fo.×Ve. ♀ × *P. vers.* ♂). Pattern of banding nearest to *versicolor* ♂. Colour hybrid.

2.	3.	4.	5.	6.	F. 2 ♀ ♀ (F. 1 Fo.×Ve. ♀ × *P. vers.* ♂).
"C"	"E"	"H"	"F"	"B"	

Although slight differences exist between these five secondaries, yet the length and colour of them, the horizontal setting of the bands, their breadth and bifurcated ends, are all pure female *versicolor* characters.

Plate LXVI.

♀ posterior interscapulars of the two Parent species, of F. 1 and F. 2.

1. *P. versicolor* ♀.
2. *P. formosus* ♀ (parent of F. 1).
3. F. 1 ♀ "Y" (parent of *inter se* F. 2). Pattern transference. Pattern found on several *anterior* interscapulars of *P. versicolor* ♀.
4. F. 1 ♀ "Z" (parent of F. 2, Fo.×Ve.×Ve.).
5. F. 2 ♀ "E" (moult completed). ♀ *versicolor* posterior interscapular pattern.
6. F. 2 ♀ "F" (moult completed).
7. F. 2 ♀ "H" (moult completed). Pattern transference. The pattern seen on these two feathers is found on some *anterior* interscapulars of ♀ *versicolor*.
8. F. 2 ♀ "C" (aged 4 months, moult incomplete). Pattern found amongst *posterior* interscapulars on ♀ *versicolor*.
9. F. 2 ♀ "B" (moult completed). Pattern found amongst *anterior* and *posterior* interscapulars on ♀ *versicolor*.

Note, July 2nd, 1912.—A number of posterior and anterior interscapulars extracted from a living female *versicolor* in my pheasantry showed all the patterns figured on Plate LXVI.

Plate LXVII.

♂ posterior interscapulars of the two Parent species, of F. 1 and F. 2.

1. } 2. } *P. versicolor* ♂.
3. } 4. } *P. formosus* ♂.

5. F. 1 ♂ "A" (Fo.×Ve.). Similar patterns found on posterior interscapulars of ♂ *versicolor*.
6. F. 1 ♂ "B" (Fo.×Ve.). Coarser lines but same pattern as found in some posterior interscapulars on ♂ *versicolor*.
7. F. 1 ♂ "C" (Fo.×Ve.). Similar pattern found amongst posterior interscapulars on ♂ *versicolor*.
8. F. 2 ♂ "A" (Fo.×Ve.×Ve.).
9. F. 2 ♂ "G" (Fo.×Ve.×Ve.). Pattern found amongst interscapulars on ♂ *versicolor*.

Note, 2nd July, 1912.—A number of posterior and anterior interscapulars were extracted from a male *versicolor* now living in my pheasantry; amongst these were found all the various patterns pictured on Plate LXVII. There is a difference between central and lateral interscapulars, the centrals have the pattern both sides, the left laterals have the pattern on the left side, the right laterals have the pattern on the right side.

27. A List of Moths of the Family Pyralidæ collected by Felix B. Pratt and Charles B. Pratt in Dutch New Guinea in 1909–10; with Descriptions of new Species.

By Sir George H. Kenrick, F.Z.S.

[Received January 30, 1912: Read March 19, 1912.]

(Plate LXVIII.*)

Index.

After some considerable experience in British New Guinea, the two sons of Mr. A. E. Pratt made several attempts to explore various portions of the Dutch territory, and although disappointed in some directions they made a very successful ascent of the Arfak Mountains, formerly visited by d'Albertis, and spent a considerable

* For explanation of the Plate see p. 555.