

Meanwhile the history of racial conflict and conquest will repeat itself. And its great paradox will not seldom also be repeated. As in the old world Greek slaves and Jewish outlaws proved stronger than their Roman conquerors, so in the future will races and their empires that rest on force be swayed and transformed by invulnerable revolutions of the mind.

SEASONAL VARIATION WITH SPECIAL REFERENCE
TO THE GENUS JUNONIA

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The subject of variation is a study of no little importance, inasmuch as it is probable that it will throw more light on the vast subject of the inception of new species than any other investigation. It, moreover, requires co-operation on a large scale because for its pursuit large numbers of specimens from properly authenticated localities and duly dated are necessary. Breeding on an extensive scale is of primary importance, and is sure to repay the trouble by the interest of the results obtained if carried on with due care. The butterflies especially are suitable for experiments of this nature, because they are so variable and are influenced by so many different conditions. Not only do the males and females show great differences in many cases, but most species of wide distribution show considerable, and in some cases large, amounts of variation in different geographical areas. It is, for instance, often possible to say at a glance whether specimens of many species have come from East or West Africa. In this case specimens which come from the districts where these two areas overlap are of the first importance.

Then, again, in butterflies there are often marked differences between the specimens characteristic of the wet season and the dry season respectively, and these differences reach their highest development in Africa. Owing to the fact that our wet and dry seasons are not so well defined as in other parts of the continent, it may happen that one form does not occur at all

in certain areas. For instance, well-marked specimens of the dry phase of the genus *Teracolus* (orange tips) are hardly ever to be found in the damp districts of the coast and are very prevalent in the colder and dryer districts in the highlands; in fact I have my doubts whether the full dry form in this genus is ever produced by drought alone apart from cold. The special subject of this paper is however the seasonal forms in the genus *Junonia* or *Precis*. I have chosen this genus because it is specially suitable to illustrate the subject, and, moreover, it contains the most diverse seasonal forms at present known. In the first place, there are four species of the genus which exhibit the variation in its simplest form. All of these are ornamented with large blue spots in the hind wing. They are *J. clelia*, *J. hierta*, *J. boopis* and *J. westermanni*. All except the last are to be found all over the country, but *J. westermanni* is only to be found to the west of Nairobi, and I should add that its female has no blue and differs much from the male; it is possibly mimetic. In all these species the only difference between the two phases is to be found on the underside. In the dry form all the markings tend to become more or less obsolete, especially the eyespots which are easily to be distinguished in the wet phase. Both forms are distinctly protective, the butterflies very frequently settle on the ground, but the wet phase is less protective than the dry.

The next two species to be considered are *J. elgiva* and *J. aurorina*. Both these resemble those already mentioned in that the markings of the underside tend to become obsolete in the dry phase, but they differ in one respect—and that is the more perfect resemblance to a dead leaf of the dry phase. This is produced not only by the obsolescence of the eyespots but also by the development of a marking across all the wings from the tip of the fore wings to the anal angle of the hind wings which resembles the midrib of the leaf. The resemblance to the dead leaf is marked in both forms, especially in *J. aurorina*, but it is much more marked in the dry form. There is another difference, moreover, which is nearly always to be found in these 'dead-leaf' butterflies, i.e. the shape of the wings is different. In the dry form the projection below the tip of the fore wing and the 'tail' at the anal angle of the hind wing

are both much produced in comparison with those of the wet phase, so that it is possible from this character alone to say whether a specimen is a dry form or not.

This has been explained on the ground that dead leaves in the dry season are invariably much curled, and the strongly accentuated productions of the extremities of the wings produce this appearance in the butterflies. *J. natalica* shows differences very similar to the last two species except in one particular. *J. natalica* possesses in the wet form conspicuous white spots, which are probably directive marks, i.e. their function is to attract the attention of a prospective enemy and invite attack on an unimportant part of the structure.

It is obvious that such spots, which in the wet phase probably represent fungoid growths, would interfere considerably with the resemblance of the dry phase to a dry and withered leaf. Accordingly we find that in the full dry phase there is no trace of these spots whatever; but intermediate forms are to be met with, in which the spots exist, but they have become so diffused and harmonise so beautifully with the other dead-leaf markings that they hardly detract at all from its protective character.

There still remain the two most remarkable butterflies of the genus from this standpoint. The first of these is *J. sesamus*. The wet phase of this species is a salmon red butterfly with a black border marked with white lunules and other black spots and markings. The underside is very similar to the upper side, except that the ground colour is paler and so the black markings are more conspicuous. It is, however, much less easily seen than one would think, especially when seated on the ground. On the wing it is certainly very conspicuous, and there is some reason to believe that, in spite of its different shape, it is mimetically associated with *Acreas* such as *A. acara* and *A. anemosa*, and in some places *A. astrigera*. The dry phase is a very different-looking insect. It is a beautiful shade of blue, with darker markings which do not at all coincide with the black markings of the wet phase. On the underside it is of a dark dusky colour with a distinct green shade in it, which is very protective in shady places amongst rocks, the favourite resort of this phase. I should have said

that the salmon red of the wet phase is represented in the dry phase by a discal row of red spots across all the wings. It is, perhaps, needless to add that the two phases were looked upon for many years as quite distinct species and that systematic naturalists were only convinced by the actual breeding of one form from the other. This was first accomplished by Mr. G. A. K. Marshall in 1898. The phases of *J. antilope* are hardly less remarkable. In this species the wet form resembles that of *J. sesamus*, except that the salmon red is replaced by fulvous, and it is of course a much smaller insect. The resemblance in colour on the underside is much more marked and it is equally conspicuous. The upper side of the dry form resembles the wet form in colour, but the shape of the wings is quite different. The projection below the tip of the fore wings and the tail at the anal angle of the hind wings are much accentuated, though they can hardly be traced at all in the wet season phase, and the under side of the wings bears a very strong resemblance to a dead and withered leaf with a prominent mid-rib. It is by no means improbable that these last two species have made considerable progress towards splitting up into two species, and that under favourable conditions the development into distinct species might be rapidly effected. There can be little doubt that other forms, at present regarded by most naturalists as distinct species, will in the future have to be united, and the study of these forms which can only be undertaken by one living on the spot, since it involves breeding on an extensive scale, will amply repay the trouble and time expended. One such species is *J. archesia*. The wet form is a brown butterfly with a broad band of ochre-yellow across all the wings, both above and below. The dry form is very rare, if indeed it occurs at all in British East Africa. It is similar above, but the ochre-yellow band is much narrower, and the eyespots which exist beyond it are white. On the underside the broad band narrows into a midrib and other subsidiary paler markings are developed, increasing the resemblance to a dead leaf. We have, however, another form known as *J. limnoria*, which is probably only a form of this species and resembles it closely in the wet phase, but in the dry phase this last is banded on the underside with

several narrow bands which appear conspicuous in the cabinet, but which harmonise so beautifully in nature that it is almost impossible to detect a specimen at rest among dead leaves. Neither of these species has yet been bred through, and it would be of the highest interest to do so. *J. archesia* is common in some parts of Kikuyu and *J. limnoria* in Taita, &c. Other species of the genus exist in other parts of the country, but I have confined my observations to those with which I am familiar, and they will perhaps be sufficient to indicate the interest of the subject.

THE DISTRIBUTION OF GAME IN UGANDA

BY F. A. KNOWLES

The Game animals of the Uganda Protectorate are practically all common to East Africa, with the exception of the *Cobus thomasi*, or Uganda kob, which do not live east of Lake Victoria, and a small variety of the tragelaphus known as the harnessed antelope. On the other hand, many of those of East Africa are not found in Uganda, such as the Grant's and Thomson's gazelles, the oryx, Coke's hartebeest and wildebeest.

The distribution varies according to the altitude and natural features of the country and the various kinds of grass, scrub, &c. best suited to the different species. In some places the animals of certain species are curiously detached in small herds, which occupy an area of a few square miles, divided from their fellows by huge tracts of country—noticeably the impala—having, it would appear, been killed off either by the natives or by disease in the intermediate spaces, and so become isolated.

Practically half of the province of Buganda and of the districts of Toro and Unyoro is covered with what is known as elephant grass, where no animals but the elephant and buffalo (excepting lion, leopard, and pig) can live. This confines the habitat for the antelope and gazelle to considerably less than