In order that the stock, more especially the calves, may be able to get water without going down into these deep pits, the natives make enormous saucers of mud, to fill which they have to draw water in earthen pitchers. A large part of every day is employed in making and repairing these saucers and keeping them filled.

AN INTERESTING POLYMORPHIC BUTTERFLY

By D. G. Hale Carpenter, M.D., F.E.S.

During a stay of fourteen months' duration on Bugalla Island—one of the Sesse Archipelago in the north-west corner of Lake Victoria, on which I was investigating the bionomics of *Glossina*—I was able to make an extraordinarily interesting collection of butterflies of the Nymphaline genus, *Pseudacræa*, which are very excellent mimics of sundry species of the Acræine genus, *Planema*. These models are of the following types. In one, both sexes have the same colour and pattern; the wings have a very dark brown ground colour with a tawny orange band across the fore wings and a white band across the hind wings (*Planema poggei*). In another type the wings are black with white patches (*Planema macarista* and *Planema alcinoe*, the female sex only. The male *macarista* is of the same type as *poggeoides*; the male *alcinoe* is of a different type again and is not a member of the mimetic combination about to be described). In a third type the fore wings are dark fulvous brown with two orange areas and the hind wings are orange with dark border. Both sexes of this species (*Planema tellus*) are alike. In a fourth type in which also both sexes are alike, the wings are dark fulvous, with creamy blotches (*Planema epœa*, form *paragea*). Each of these types is very closely copied by forms of the Nymphaline genus, *Pseudacræa*, that resembling the first type was known formerly as *Ps. Hobleyi*, male, the corresponding female resembling type two. That resembling the third type was known as *Ps. terra*, both sexes alike, and

the sexes were similar also in *Ps. obscura,* resembling the fourth type.

These several models and mimics have been made known largely through the collections made by Dr. Wiggins at Entebbe, in the forests near to which all these forms may be taken flying together. The various models of genus *Planema* are undoubtedly of different species. Some time ago, however, Dr. Karl Jordan of Tring suggested that all the forms of *Pseudacræa* mentioned were of one species, basing his hypothesis on the anatomy of the male armature. When I went out to Bugalla Island in 1912 I soon found that all these forms of *Pseudacræa* were very abundant, but extraordinarily variable, so that specimens intermediate between any of the other types were as common as the type; this very strong evidence in favour of Dr. Jordan's hypothesis was confirmed in August 1912, when I was able to breed, from ova deposited by one form, types of other forms, and intermediate specimens so that the four forms of *Pseudacræa* mentioned are all of one species, accurately resembling different species of *Planema,* some of which have the sexes similar, some dissimilar. I may say that the resemblance of model to mimic is extraordinarily close, and for a long time I was deceived over and over again. The *Pseudacræa,* is however, very much more wary than the model and never rests with the complete 'abandon' exhibited by the *Planema.* One learns to recognise them apart by degrees, mainly through the different habit of flight.

The particularly interesting feature about the island *Pseudacræa* was the extraordinary degree of variability. The large collections of the same species made by Dr. Wiggins on the mainland at Entebbe, only some twenty-five miles north-east, show that the mimics there keep very true to the types of their models and specimens intermediate between two types are excessively uncommon. The great variability of the *Pseudacræa* on the island was correlated with great scarcity of models. Indeed during the fourteen months on Bugalla, of one model (*Planema poggei*) I only caught two males. The mimics many times outnumbered the models. I believe this fact supplies the reason for the great variability of the mimics. On the mainland, where the model *Planema* is

abundant enough for its presence to be of protective value to the mimic, any *Pseudacræa* which is produced that does not conform very closely to the well-known distasteful model is more likely to be destroyed by enemies than a specimen which is almost indistinguishable from the model.

On the island, however, the models are so extraordinarily scarce that an enemy of *Pseudacræa* might quite conceivably never see one—hence their presence can have very little protective value for the *Pseudacræa*, so that a variety of *Pseudacræa* would have as much chance of surviving as a specimen conforming as closely as possible to the type of a model. If this explanation be the correct one the facts form a most convincing proof of the reality of mimicry, and of the power of natural selection to keep mimics up to the mark.

The reason for the scarcity of models on the island is not certain—I believe it to be due to scarcity of food plant. The instances I have given do not nearly exhaust the complexity of this *Pseudacræa*. In West Africa there are many forms, all believed by Dr. Jordan to be of this species. One, known as *Ps. eurytus*, gives the name to the whole of this polymorphic group, as it was the first one to be named by Linnæus. The male of this is reddish orange and black—the female black and white but of a pattern different from the black and white form already mentioned—the two sexes of this form copy accurately the two sexes of the model *Planema epœa*. In East Africa another dimorphic form exists, copying the dimorphic *Planema aganice*, form *montana*, this mimic, known as the form *Rogersi*, is known by a single specimen of each sex.

In Natal occurs another form of this protean species of *Pseudacræa*, known as *imitator*; male and female are black and white, copying the corresponding sexes of the model (*Planema aganice*): the male is creamy where the female is white, so that, if we consider the various forms of *Pseudacræa eurytus*, we find that in some localities the two sexes are alike, in others they are different, and in other places, as in Uganda, forms occur in which the two sexes are alike, mixed with other forms and with different sexes, and yet all of one species, breeding freely together. I have seen specimens of very different forms courting, and, as I have said, have bred one form from ova

laid by another. No other explanation of this extraordinary state of affairs is so satisfactory as the hypothesis of mimetic resemblance, whether that of Bates, which claims the mimic to be an edible species living on the reputation of a distasteful species which it so closely resembles; or the theory of Fritz Müller, which claims that each species gains by the evil reputation of the other. Each of these hypotheses depends upon the great fact of natural selection: and it is claimed that the facts brought forward in this short paper show the reality of mimicry, and of the power of natural selection to enforce it.

DESCRIPTIONS OF THREE NEW AFRICAN WEAVER-BIRDS OF THE GENERA *ESTRILDA* AND *GRANATINA*.

By Edgar A. Mearns, *Associate in Zoology, United States National Museum.*

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This paper is the nineteenth dealing with the results of the Smithsonian African Expedition under the direction of Col. Theodore Roosevelt. It includes one new form from the collection of the Childs Frick African Expedition.

The names of special tints and shades of colours used in this paper conform to Robert Ridgway's 'Colour Standards and Colour Nomenclature,' issued March 10, 1913. All measurements are in millimètres.

Estrilda rhodopyga polia, new subspecies

(Gato Waxbill)

Type-specimen.—Adult male, Cat. No. 247,436, U.S. National Museum; collected on the Gato River, altitude 4,000 feet, Southern Abyssinia, May 2, 1912, by Edgar A. Mearns. (Original number, 21,687.)

Characters.—Similar to *Estrilda rhodopyga rhodopyga* from