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Species, class and individual characteristics in the African Wattled Starling, *Creatophora cinerea*

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Abstract. Variation in head characters, wing colouring, ecological adaptations, the social system, and subtle behaviour was studied in the social Wattled Starling, *Creatophora cinerea*. The studied characters were attributed to four distinct classes of characters (character groups). Under captive conditions great individual variation was found in head characters, wing colouring and behaviour. The variety of existing "social niches" might be occupied by means of the marked variation in behaviour and appearance and their potential interdependence.

Key words. *Creatophora cinerea*, stable species characters, periodically changing species characters, class characters, individual variation.

Introduction

The Wattled Starling, *Creatophora cinerea* (Meuschen, 1787), is distributed in savannah habitats from southwestern Africa, over South Africa, and East Africa to Ethiopia, and sometimes even arrives at the Arabian peninsula (Hall & Moreau 1970). An outstanding feature of the species is the high degree of individual variation in external appearance: head characters and wing colouring are highly variable (cf. Sontag 1983).

Wattled Starlings are extremely social (Liversidge 1961). Outside the breeding season, they wander around nomadically forming swarms of different size. During the breeding season, they set up big colonies of differing size. The breeding colonies are divided into sub-units.

So a broad variation is found in external characters, as briefly shown previously (Sontag 1985), as well as in ecological adaptations and social system. Subsequently, the extent and (possible) rules of variation on these different biological levels will be outlined. Moreover, I was searching for evidence for the assumption if a number of behavioural elements were restricted to particular individuals and/or a high degree of variation in the occurrence of and within given behavioural elements corresponding to the marked variation on the other biological levels. In detail I observed subtle behaviour in individuals kept in aviaries. Under these conditions data on head and wing variation could easily be gathered.

The variability of biological characters was analyzed from four perspectives according to four character groups:

- (1) stable species characters,
- (2) periodically changing species characters,
- (3) characters typical of certain classes of individuals,
- (4) characteristics typical of specific individuals.

Study animals

The investigation was started at Frankfurt/Main Zoo, where Wattled Starlings were bred and reared in considerable numbers. For more detailed observations several groups of Wattled Starlings were kept in spacious aviaries in three different places (University of Mainz; Mainz Municipal Park; garden-aviary near Mainz). The study lasted for over ten years.

Character groups

1. Stable species characters

These characters are found in all individuals that are independent of parental feeding.

External appearance. The rump feathers form a conspicuous white patch contrasting with the surrounding feathers. During flight the rump patch is visible. — The eye and the bill axis lie in a straight line; the chin-parts have a concave profile.

Social aspects. Outside the breeding-period Wattled Starlings form flocks and wander around nomadically (Liversidge 1961). Another typical feature of *Creatophora* is communal roosting in large numbers as known in other starlings.

Behavioural patterns. Basic motor patterns (e. g. stretching patterns, bathing elements. etc.) are found in all individuals. This includes open-bill probing, a behaviour that the bill-eye-area is morphologically adapted to (see above).

The absence of various social behaviour patterns found in other Sturnidae (cf. Rowan 1955, Sontag 1983) is characteristic of *Creatophora*: I have never seen pair-feeding, billing, allo-preening and duetting.

2. Periodically changing species characters

External appearance. Regardless of great variation in detail a change between relatively uniform “non-breeding plumage” and a “nuptial plumage” occurs in all individuals.

Social aspects and breeding. Wattled Starlings either breed “seasonally” in relatively small colonies of up to 400 nests, or “opportunistically” in case of mass reproduction of locusts, in enormous colonies of thousands of individuals (Liversidge 1961). Opportunistic colonies tend to be unstable and may be deserted if the food supply fails (McLachlan & Liversidge 1970). Depending on food supply, clutch size differs (Hoesch & Niethammer 1940).

3. Class characters

Most characters can be attributed to this section of characters. Classes can be distinguished according to sex, age and the way of nesting.

External appearance: head. In the “non-breeding plumage” the head is feathered except for two naked areas on each side, i. e. a yellow temporal and a black chin stripe (Fig. 1a). The “nuptial plumage” varies considerably influenced by age, and sex. The feathers on the head can be missing, to a varying extent, showing black and yellow skin areas respectively. On the forehead 1–2 wartlike appendages may appear. The chin stripes can develop into wattles of varying size which, in the extreme, form one

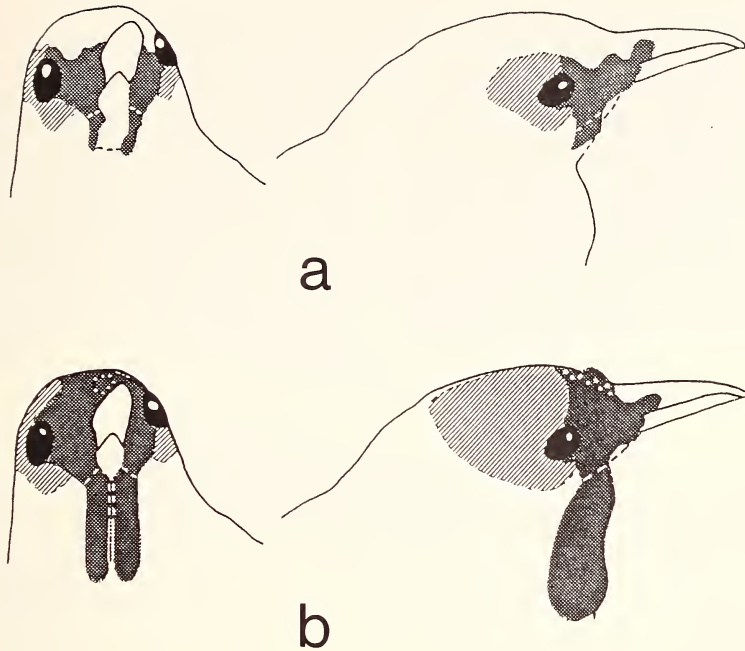


Fig. 1: a: "Non-breeding plumage" of a σ . b: "Nuptial plumage" or "breeding plumage" (at maximum) of the same σ . Stippled areas: featherless black zones. Hatched areas: featherless yellow zones. For more details see text.

large wattle (Fig. 1b). Q get breeding plumage characters on the head later in their lives than σ , and to a smaller extent than the latter.

External appearance: wings. Wing colouring and wing markings differ considerably (e. g. Fig. 2a, b). The individual patterning of the alula and upper wing-coverts is strongly influenced by age and sex. The greater covert feathers vary in colour from blackish to white and may even be nonuniform. σ get light feathers at an earlier age and more extensively than Q .

Nesting habits. Several kinds of nesting are observed. Wattled Starlings breed either in single nests, or in nesting communities that are composed of 2–8 nests (Liversidge 1961). Each nest is occupied by one pair of birds. Moreover, three types of non-breeding nests have been found: "play nests" (own obs.), σ -nests, and non-breeding nests in breeding colonies (Liversidge 1961). The role of these nests and classes of individuals that build these nests have not been fully understood yet. Perhaps relatively young individuals having no mate tend to build "play nests", yearlings may construct non-breeding nests in the colony.

Behavioural patterns: male. σ produce "undirected" (i. e. not- Q -addressed) songs accompanied by wing-waving.

Courting σ show three different types of display. First they present themselves laterally to the Q ; this courting type is followed by a frontal display. When the sexes

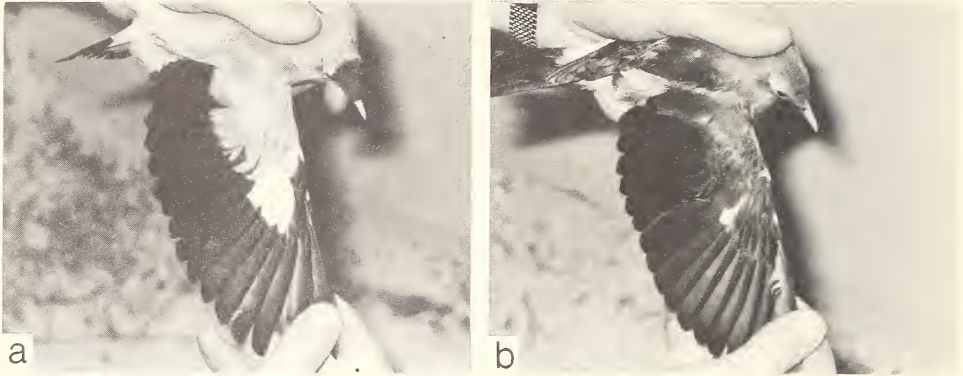


Fig. 2: Right wings of two individuals. a: wing of a ♂. b: wing of a ♀.

are synchronized the ♂-display is modified (Sontag i. prep.). All display types include singing and visual components. The ♂ conspicuously presents the wing and (part of) its marking(s) to the ♀. After the copulation the ♂ again displays the wing-marking(s), straightens up, puffs up the breast plumage, and presses the wings to his body like in vultures. The wings seem edged and markedly length-folded.

Behavioural patterns: female. ♀-specific behaviour is obvious on four functional levels: rejection of courting ♂, sexual courting for ♂ (see Fig. 3; Sontag i. prep.), approaching the (potential) mate, and soliciting behaviour. ♀ approaching the (potential) mate land close to him and immediately spread the wings from the body ("spread-eagle posture"). The soliciting posture is characterized by intense tail-shaking; hereby the rectrices appear to be fanned.

♀ are able to sing, but their songs do not achieve the quality of full ♂-songs. Depending on their age ♀ behaved differently while singing: old ♀ waved their wings, young individuals did not.

4. Individual characteristics

External appearance. Head: There is enormous variation, because a lot of modifications and intermediate stages of the breeding-dress actually occur. — *Wings:* Both remiges and feathers of the alula and coverts are subject to marked individual variation in colour (e. g. grey, white, brown; see Fig. 2a, b).

Social relations. Selective sexual attraction was observed between certain individuals.

Behavioural patterns. Individual variation in "self-related" behaviour was observed in different respects: (1) quantity of a behaviour (i. e. sun-bathing), (2) extraordinary use of behaviour commonly exhibited in a different context (i. e. open-bill probing of a ♂ in his own rectrices), (3) a missing behaviour being intraspecifically widespread (i. e. anting).

Marked individual variation in socially relevant behaviour was observed:

- (1) 6–7 behaviour patterns were only found in particular individuals, i. e.
- (a) pre-flight wing-flaps on the perch;



Fig. 3: A sexually courting ♀ is performing a specific “vulture posture”. The wings are pressed to the body parts.

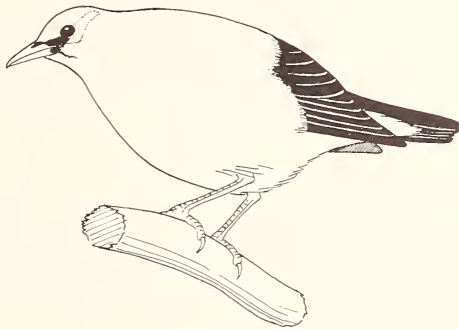


Fig. 4: ♀ Red-Ring exhibiting a sexual behavioural pattern, the “thrush posture”. This behaviour was typical of this particular ♀. It has the same function as the posture to be seen in Fig. 3.

- (b) excitation flights;
- (c) sun-bathing with partial wing-spreading;
- (d) “hesitating approach intention display” of a dominating ♂;
- (e) a sexual refusal pattern in a ♀;
- (f) when sexually courting for a ♂, a ♀ performed a display which can adequately be named as “thrush posture” (Fig. 4) and which had the function of usual female courting patterns (cf. Fig. 3);
- (g) wing-quivering behaviour of an inferior ♀.

(2) Inter-individual differences were also present within given behaviour patterns, i. e. in wing waving of singing σ , courting of σ (see 3.), a male pose after pairing (cf. 3.), and sexual courting of φ (Sontag i. prep.).

Discussion

Obviously, the breeding and nesting behaviour of Wattled Starlings is subject to considerable variation (e. g. Liversidge 1961). Thus a lot of possible "social niches" are offered to the individuals during life-time. Correspondingly conspicuous morphological qualities, i. e. head characters and wing colouring show strong variation as pointed out above. Wattled Starlings exhibit many different expressive behaviour patterns (own obs.); additionally pronounced variation is found in social behaviour. Further inter-individual differences are expected to include quantitative aspects of agonistic behaviour (cf. Sontag 1983). In interaction with the conspicuous morphological markings of high variability, varied behavioural patterns could be a means by which individuals occupy the great variety of different "social niches" that have actually been described within the social organization, the latter being modified by ecological conditions viz. constraints. Thus the four biological levels the significance of which was documented for *Creatophora* largely determine the frame of the "social niches". Although individual differences suggest the importance of genetic factors for occupying a defined "social niche", the subsequent example clearly hints at other factors that might also exert a strong impact (e. g. group members) on an individual's role: A φ continually showed signs of a specific conflict position within the group, expressed by head plumage ruffling, restless (locomotory) motions, and changes between σ and φ behaviour; she was seen to perform displacement-preening, attempts of reversed copulatory behaviour with one particular σ , and "courtship singing".

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Zusammenfassung

Die Variation morphologischer und feinethologischer Merkmale sowie ökologischer und sozialer Anpassungen wurde beim Lappenstar *Creatophora cinerea*, einem hochsozialen Sturniden, an Hand eingehender Langzeit-Untersuchungen und unter Nutzung vorliegender Literatur untersucht. Gemäß ihrer innerartlichen Verbreitung wurden die Merkmale vier Merkmalsklassen zugewiesen: 1. den beständigen, 2. den periodisch wechselnden Artmerkmalen, 3. den Klassenmerkmalen (Zuordnung nach Geschlecht, Alter, Nesttyp), 4. den individuellen Eigenheiten. Beständige Artmerkmale sind weißes Bürzelgefieder („Bürzelspiegel“), die Hohlkehle im Bereich von Schnabelwurzel bis Augenpartie, das Formieren zu Schwärmen, das Nächtigen in großen Schlafgesellschaften und Gebrauchshandlungen, wie z. B. das Zirkeln. Die Aufeinanderfolge von Schlicht- und „Pracht“-Kleid sowie die Fortpflanzung in ökologisch bedingt verschieden großen Brutkolonien sind den periodischem Wechsel unterliegenden

Artmerkmalen zuzuordnen. Geschlechts- und altersbedingte Unterschiede bestehen im Erscheinungsbild des Kopfes und in der Farbgebung der Flügel. Andere Klassenunterschiede ergeben sich aus dem Auftreten verschiedener Nesttypen (Einzelnester; Nester in „Nestergemeinschaften“; „Spielnester“; ♂-Nester; „Nicht-Brut-Nester“). Geschlechtsspezifisches Verhalten wird behandelt. Altersbedingt treten im optischen Ausdrucksverhalten der ♀ beim Singen Unterschiede auf. Auffallend sind die drastischen individuellen Unterschiede im Habitus (Kopf, Flügel), in der Wahl des Geschlechtspartners und bei „selbst-bezogenen“ Verhaltensweisen. Mehrere sozial relevante Verhaltensweisen waren auf bestimmte Individuen beschränkt, bei anderen Ausdrucksweisen wurde individuelle Variation festgestellt. Dies wird interpretiert als deutlicher Hinweis auf Anpassungen an die große Zahl „sozialer Nischen“, die in dem vermutlich durch die ökologische Spezialisierung bedingten komplizierten Sozialsystem des Lappenstars möglich sind.

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