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GEOGRAPHICAL VARIATION IN PALM SWIFTS CYPSIURUS SPP.

(*AVES: APODIDAE*)

by

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INTRODUCTION

This paper examines the species and races proposed in the genus *Cypsiurus* Lesson, 1843, in the Apodidae. The genus itself has been almost universally accepted throughout this century. No overall review of infraspecific variation has been made since 1892 when Hartert's work appeared in the *Catalogue of Birds in the British Museum*, vol. 16. Two new races are proposed and one not usually recognised is supported. Much of the work on which this paper is based was done while holding a Frank M. Chapman memorial grant from the American Museum of Natural History, New York. In addition to the curators and museums listed in Brooke (1971a), I am obliged to Dr. G. F. Mees of the Rijksmuseum voor Natuurlijke Historie in Leiden for the loan of material and for permission to select

a type from the material lent. As usual, delta-length means the distance between the fourth and fifth rectrices when the tail is held closed.

SPECIES WITHIN THE GENUS

The genus *Cypsiurus* is distributed throughout tropical Africa and tropical Asia as far as Java and the Philippines and is usually common in areas which contain tall palm trees. Particularly in Africa, it also breeds on man-made structures such as bridges and buildings and has thus recently expanded its range in detail and its total numbers (Brooke 1963, 1971a). *Cypsiurus* is characterised by its small size, dull plumage, toes placed forward in opposed pairs with a reduced number of phalanges (2, 3, 3, 3), and nest in the shape of a vertical wall with a lip at the bottom to which the eggs are glued. The nest is made of feathers and vegetable down cemented together with saliva and placed on a palm frond, a tunnel in thatch, or a high sheltered nook on the outside of a man-made structure.

Whistler & Kinnear (1935), in discussing a collection from the Eastern Ghats of India, end up their brief discussion of their specimens of this genus by saying "in my opinion we (*sic*) can only consider *batassiensis* and *infumatus* as races of the widely spread African Palm Swift *Cypsiurus parvus*". On the strength of this hardly adequate discussion virtually all workers have lumped *parvus* Lichtenstein, 1823, and *batasiensis* J. E. Gray, 1829, without further comment. In point of fact, *parvus* and *batasiensis* differ in a number of significant characters and should be treated as separate species. *C.parvus* in tropical Africa has in the adult a streaked throat; the fifth (outermost) retrices greatly elongated beyond the fourth (delta-length *c.* 3 cm), as well as being markedly emarginate; tail-fork in adults more than 5 cm deep; a distinctive juvenal plumage in which most feathers and particularly those of the wing, tail and under tail-coverts are tipped with dull buffy; a sub-adult plumage which can be recognised by the shape of the fifth rectrix, which is neither unemarginate and rounded as in the juvenal plumage nor highly emarginate as in the adult, and whose delta-length is 1,5–2,0 cm. *C.batasiensis* in tropical Asia has an unstreaked throat in the adult; fifth rectrices which are not particularly emarginate and with a delta-length of less than 1 cm; tail-fork less than 4 cm deep; a juvenal plumage in which the feathers have dull white tips; no recognizable sub-adult plumage. There are no intermediates between these species. *C.gracilis* (Sharpe), 1871: Madagascar, differs from *parvus*

in that in the juvenal plumage the fifth rectrix has the shape and emargination of the sub-adult fifth rectrix of African birds, and the throat is well streaked. It lays a clutch of three eggs, not two as in African *parvus*. *C.gracilis* possesses the streaky throat, buffy tipped feathers in juvenal plumage, and emarginate fifth rectrices albeit with a slightly shorter delta-length of *c.* 2,5 cm. The Madagascar birds are doubtless derived from those of Africa, and are best treated as a race of *parvus*, though they could be treated as a species within the *parvus* superspecies since they differ from nominate *parvus* far more than any African race does. *C.parvus* can be called the African Palm Swift and *C.batasiensis* the Asian Palm Swift.

The name *batasiensis* has three other spellings in the literature: *balasiensis*, *balassiensis* and *batassiensis*. There are two variants: "s" versus 'ss' in the middle and "t" versus 'l' in the third letter. The original spelling in Gray (1829) is *balasiensis* and is based on Latham (1823) who called it the Balassian Swift because the Bengali name is 'balassia'. Baker (1927) pointed out that the Bengali name is batassia; that Latham had forgotten to cross the 't' in his MS., and that in view of this slip of the pen (*lapsus calami*) Gray's name should be amended to *batasiensis*. Ripley (1961) concurred in Baker's decision. The use of one 's' or two in representing a word (batassia) normally written the Bengali (or any other non-Latin) alphabet is of little importance; is unlikely to be a *lapsus calami* and does not require correction. In view of Baker's (1927) facts and Ripley's (1961) support sound nomenclature is best served by calling the Asiatic species *Cypsiurus batasiensis*.

GEOGRAPHICAL VARIATION

C. parvus breeds throughout ethiopian Africa south to the Transvaal and Natal, on the Gulf of Guinea islands except Annobon, on the islands of Pemba, Zanzibar, the Comoros and Madagascar. *C.batasiensis* breeds in India and Ceylon east to Hainan, the Philippines and Java. Geographical variation affects chiefly the general colour of the plumage and to a lesser extent wing- and delta-lengths. Only in continental Africa is a distinct sub-adult plumage discernible.

The darkest races of *parvus* are *brachypterus* in the evergreen forest belt of west and central Africa, *griveaudi* in the Comoro Islands and *gracilis* in Madagascar, and all live in high rainfall areas. In-

creasing pallor appears successively in *myochrous* of the eastern plateaus from Uganda to the Transvaal, *laemostigma* of Kenya and the eastern lowlands from Somalia to Natal, *parvus* from Senegal to the Sudan, and *hyphaenes* in northern Botswana to south-western Angola. The increasing pallor is matched by the increasing aridity of the environment.

Wing-lengths and adult delta-length averages correspond. The form with longest measurements is *hyphaenes*, and in descending order thereafter we find (Table 1) southern *laemostigma*, *myochrous*, *parvus*, *brachypterus*, northern *laemostigma*, *griveaudi* and *gracilis*. The rather small weight samples do not fall into quite the same order as the linear measurements: in descending order they are southern *laemostigma*, *myochrous*, *hyphaenes*, *brachypterus* and northern *laemostigma*.

Since the difference between the continental races of *C.parvus* are largely ones of shade and tone of colour with minor differences in weights and lengths, it might be held that no such races should be recognised. However, the zones of intergradation are narrow and two of the most distinct races, *parvus* and *brachypterus*, abut without apparent intergradation in the area where the Sudan, Uganda and north-eastern Zaire meet. There is no evidence for overlap so there is no reason to postulate more than one species in Africa, a species which is polytypic, and in which the facts can be reasonably represented by trinomial nomenclature.

A curious position holds in the evergreen forest race *brachypterus*, which has an isolated population in low-lying forests of the Haroni/Lusitu confluence on the frontier of Rhodesia and Moçambique, a thousand miles or so from the nearest Zairean population. The Haroni/Lusitu population is known from one specimen, which, except that it is longer winged than *brachypterus* (see Table 1), is indistinguishable from it. Subspecific recognition is not warranted at the present time.

C.p.laemostigma was sunk as a synonym of *myochrous* by Sclater (1924), but it is somewhat paler, has a heavily streaked throat, and its wing-length varies in a way different to that of *myochrous*. There is no clinal variation in wing-length in *myochrous*, but in *laemostigma* populations south of the Rovuma River have longer wings and longer delta-lengths than those to the north: averages 133,3, *versus* 128,9 mm, and 31,94 *versus* 27,26 mm (Table 1). I believe that it should be recognized.

In studying colour variation in *C.parvus* cognisance requires to be taken of two hazards due to staining which affect the appearance of specimens. If subcutaneous fat is not carefully removed in preparation it stains the plumage so that it becomes browner and darker, while birds which live in palms in railway stations and in railway bridges become darkened through staining with soot from coal-burning engines.

C.batasiensis varies chiefly in the general colour of the plumage, the presence or absence of a rump paler than the back, and the degree of furcation in the tail. The darkest race is *infumatus* from Assam to Hainan and south to Malaya. Intermediate in colour is *bartelsorum* of Java, and the pale races are *pallidior* of the Philippines and *batasiensis* of peninsular India and Ceylon. The correlation of intensity of rainfall and dark colour is not as close as it is in *C.parvus*. A rump paler than the back is confined to *batasiensis* and *bartelsorum*. Tail furcation is most marked in *batasiensis* and in descending order thereafter in *bartelsorum*, *infumatus* and *pallidior*. The same order applies to delta-lengths.

Nominate *batasiensis* shows clinal variation being palest in the arid north-west towards the Punjab, for which pale populations the name *palmarum* is available, though I do not consider it should be used since the differences are not great enough to support nomenclatural recognition. Ceylon birds are darker than topotypical *batasiensis* from Calcutta, particularly on the mantle, but are not consistently separable from Indian ones. Having seen only two Ceylonese birds, and being uncertain whether they were separable, I asked Mr. C. W. Benson to examine the British Museum (Natural History) material from India and Ceylon. He kindly writes: "There are eight specimens from Ceylon. They have been put in the same box as the nineteen Indian specimens of the nominate race, which does not surprise me. They are certainly much closer to the nominate form than to *infumatus*. I cannot separate them at all on the underside; on the upperside *on average* they are a bit darker. I certainly would not care to produce a new name for the Ceylon birds on the basis of this material." It would appear that one of the two specimens I saw in New York is particularly distinct from topotypical *batasiensis*.

Brooke (1969a) said, or at least implied, that in most fork-tailed swifts three stages, juvenal, immature and adult could be recognized by the increasing emargination of the outermost (fifth) rectrix. In fact this is only true of *Schoutedenapus myoptilus* (Salvadori) (Brooke 1971b), of *Apus acuticauda* (Blyth) (Brooke 1969b), and of *Cypsiurus parvus* in Africa.

SYNOPSIS OF RACES

Races are discussed starting in the north-west of the range and working round to the south-west. Collecting localities that help to define boundaries are given. Mensural data will be found in Table 1 and the distribution of African races is shown in Figure 1.

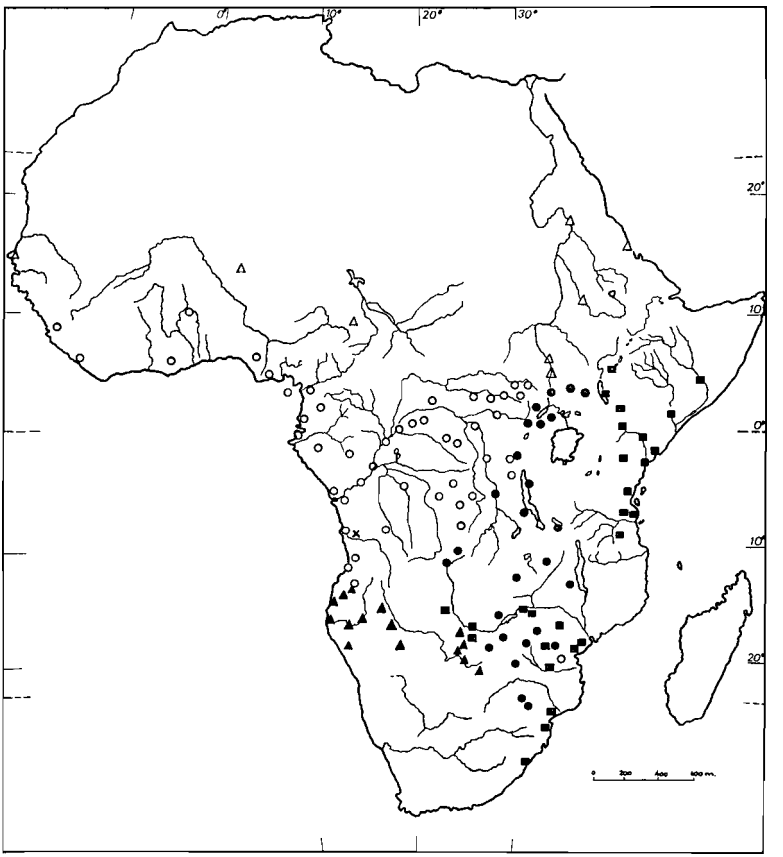


FIGURE 1

Distribution of continental races of *Cypsiurus parvus*.

REFERENCE

- ■ *C.p.laemostigma*
- △ *C.p.parvus*
- ▲ *C.p.hyphaenes*
- ○ *C.p.brachypterus*
- ● *C.p.myochrous*
- × intergrade *brachypterus/hyphaenes*

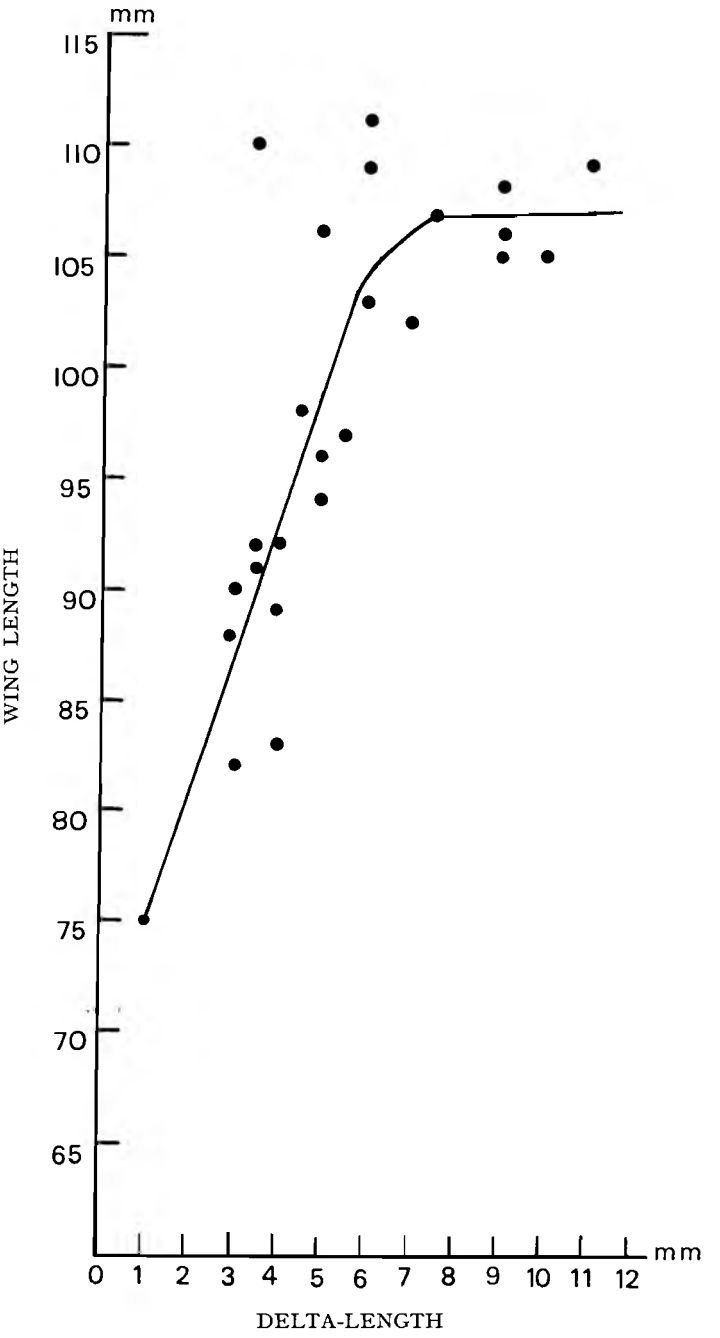
Cypsiurus parvus (Lichtenstein)

(*a*) **C.p.parvus** (Lichtenstein), 1823: Nubia, with synonyms *C.p. griseus* (Zedlitz), 1910: Adiabo Steppe, northern Ethiopia, and *C.p.ambrosiacus* (Temminck), 1828: Sudan, is a pallid race extending through the Sahel from the Atlantic Ocean to the Red Sea, south to Juba in the southern Sudan. There is a clinal decrease in colour from Senegal to the Sudan but it is not well-marked and should certainly not be named. In the Sudan the most southerly specimen I have seen is from Juba. This race does not apparently intergrade with *brachypterus*, *myochrous* and *laemostigma* which from west to east have ranges immediately to the south. Further collecting on the boundary, particularly in the area where Zaire, Uganda, Kenya and the Sudan meet, is required to elucidate ranges.

(*b*) **C.p.brachypterus** (Reichenow), 1903: Chinchoxo, Cabinda, with synonym *C.p.uamensis* (Reichenow), 1921: Upper Sanga, north-eastern Cameroon, is the darkest race, and is found in evergreen forest and adjacent moist savannas from Sierra Leone to north-eastern Zaire at Faradje, south to the Malanje District of Angola where an occasional specimen shows intergradation with *hyphaenes* to Lobito Bay. How far south of Luluabourg in Zaire it extends is uncertain. It occurs on Fernando Po, and it is probably this race which appears on Principe and São Tomé. White (1965) does not list the species from these islands, but Snow (1950) and Fry (1961) do. I have not seen material. There is no clinal variation in wing-length. This race is polytopic, a discrete population known from one specimen occurring at the Haroni/Lusitu confluence on the frontier of Rhodesia and Moçambique, where it lies between populations of *laemostigma* on the coast of Moçambique and in the Sabi Valley of Rhodesia. The one specimen is longer winged than any *brachypterus* from the main range (Table 1). Figure 2 shows that delta-length continues to increase in nestlings after they have reached their natural wing-length, and that delta-length determines when they will leave the nest.

(*c*) **C.p.myochrous** (Reichenow), 1886: Karema, Tanzania, is paler than *brachypterus* but longer winged and distinctly darker than *parvus*. It shares with both a moderately streaked throat. It ranges from the extreme southern Sudan at Torit down the eastern plateaus to the Transvaal. There is no evidence for its occurrence in Kenya. It is replaced by *laemostigma* on the east coast and up the low-lying river valleys. It does not show clinal variation in wing-length between north and south. In order to indicate the range of this form more clearly it is necessary to list peripheral localities from which I have

FIGURE 2



Relation of wing-length and delta-length growth in nestlings of *C.p.brachypterus*

seen material: ZAIRE: Lake Albert, Baudoinville, Buruli, Cangia, Ituri, Kasoko, Lualaba River, Moba, Mutambala, Mutwanga, upper Semliki; RHODESIA: Bulawayo, Manyoni, Salisbury, Sebakwe River, Umtali, south-east Wankie National Park; ANGOLA: Cazombo in the Moxico District. The Bulawayo, Salisbury, Sebakwe River and Umtali material comes from areas where the African Palm Swift breeds either in exotic palms or on bridges (Brooke 1963, 1971a). It appears that the only natural population of *myochrous* in Rhodesia was in the Gwaai drainage in the west and that it was these birds and not the lowlying *laemostigma* which expanded their range across the plateau to take advantage of man-made improvements to the environment. I have not seen material from Chipinga where it also breeds in exotic palms: these birds might be *laemostigma* since they occur nearby though usually 1 000 ft. lower down. The date of expansion of *myochrous* in Rhodesia is uncertain, though A. N. B. Masterson (pers. comm.) tells me that they started breeding in Salisbury in the late 1940's. *The Babbler*, a stencilled publication of the long defunct Rhodesia Bird Club, contains three items of interest in this connection: on p. 5 of no. 3, issued in January, 1950, E. Finlayson *et al.*, state that African Palm Swifts were a feature of the Umtali Municipal Park; on p. 9 of the same issue H. H. Hamling records having seen them in central Salisbury throughout 1949; on p. 10 of no. 5, issued in November, 1950, E. A. Edwards reports that they had been breeding at Chipinga for some years past.

(*d*) **C.p.laemostigma** (Reichenow), 1905: southern Somalia, is fractionally paler than *myochrous* but darker than *parvus*. It has the most heavily streaked throat of any continental race. It ranges from southern Somalia and Kenya down the east coast to Natal, and up the larger, low-lying river valleys such as those of the Zambezi and the Sabi. Since the dominant form in Tanzania and Rhodesia is *myochrous*, it is necessary to list localities in those countries from which I have seen material of *laemostigma:* TANZANIA: Amani, Dar-es-Salaam, Kissaki, Mahenge, Morogoro (but a Taveta specimen is *myochrous*); RHODESIA: in the Zambezi valley 14 miles above the Victoria Falls, Chewore confluence, 40 miles east of Chirundu, lower Hunyani River, Nyamaropa in the Ruenya drainage, in the Sabi valley 20 miles north of Birchenough Bridge, Chiso's, and Lundi confluence. The one specimen I have seen from the lower Luangwa valley of Zambia is so poorly preserved that racial determination is not possible, but I would expect *laemostigma* to occur there and also in the Shiré Valley of southern Malawi. It certainly occurs in ZAMBIA since it has been taken in Rhodesia all the way up the Zambezi, and a specimen from 35 miles up the South Lueti River is

also *laemostigma*. It occurs marginally in BOTSWANA, having been taken at Kazuma Pan, which is bisected by the Botswana/Rhodesia frontier. How far up the Rufiji and Rovuma Rivers it occurs is unknown, and, likewise, how far north into Ethiopia. Friedmann (1930) records it from Konso on the Sagon River. I presume that a specimen from Mogadishu in Somalia (Moltoni & Ruscone, 1940) is *laemostigma* since material from the Wadi Shebeli which I have seen is attributable to this taxon, but how far north it extends is unknown, since Archer & Godman (1961) do not admit it for former British Somalia. As noted in Table 1, birds south of Tanzania are longer winged than those to the north of the Rovuma River. Material from Mahenge in Tanzania show an approach in colour to *myochrous*, but specimens have the throat streaking of *laemostigma*, which race also probably provides the populations of Pemba and Zanzibar, but I have not seen material.

(*e*) The birds of northern Botswana west to south-western Angola are the palest of any in Africa but are unnamed. Macdonald & Hall (1957) associated them with nominate *C.parvus*, which finding I believe to be incorrect in the light of the extensive series now available in southern African collections. I therefore propose:

Cypsiurus parvus hyphaenes, subsp. nov.

Type: ♂, adult. Kumgha, on the Botletle River at *c.* 20° 30′ S., 24° 30′ E., in Botswana. 8 August 1967. Collected by P. J. G. Ginn; collector's No. P.B. 211B. In the collection of the National Museum of Rhodesia, Bulawayo, Reg. No. 71 360.

Description: Differs from all other races of *C.parvus* (Lichtenstein) by its very pale grey colour, even in the juvenal plumage. There is a clinal increase in intensity of colour towards the north-west of its range, where some individuals are difficult to separate from *myochrous*, which does not occur nearby.

Range: Northern Botswana, west to northern South-West Africa and south-western Angola. In addition to specimens from the type-locality, material from Musa, five miles west of Ngoma, Maun, Shorobe and Toromoja, also in *Botswana*, has been examined. From *South-West Africa* I examined material from Grootfontein, the Kaokoveld, Namutoni and Ondongua, and likewise from *Angola*, material of *hyphaenes* has been seen from Lagoa de Arco, Vila Arriaga, Bambo River, Cabisombo River, Chitado, Chite, Foz do Cunene, Humbe, São João do Sul, Missão do Muchimo, Pupa, Roçadas, and

Sá da Bandeira. In addition to the Bulawayo samples, material in the Transvaal Museum, in Pretoria, the Academy of Natural Sciences of Philadelphia, the Alexander Koenig Museum, Bonn, and at the Instituto de Investigação Cientifica de Angola, in Sá da Bandeira, Angola, comprises the paratypical series of this new form.

Measurements of Type: Wing 138, tail 107, depth of tail-fork 74, delta 37, culmen 6 mm.

Remarks: The name *hyphaenes* is the Greek genitive of *Hyphaene*, the genus of palm trees in which it most commonly breeds.

(*f*) **C.p.griveaudi** Benson, 1960: Grand Comoro, has the heavy streaking of the throat more extended down onto the breast than in the equally darkly coloured *gracilis*. The combination of heavily streaked throat and dark colour probably means that this race is derived from *laemostigma* but has darkened its colour in a wet environment. This is probably what has happened to the *brachypterus* type birds from the Haroni/Lusitu confluence discussed above. I have not seen material, but it occurs throughout the Comoro Islands (Benson, 1960).

(*g*) **C.p.gracilis** (Sharpe), 1871: Madagascar, is a dark race reminiscent of *brachypterus* but with the throat more heavily streaked. The streaking does not extend down onto the breast as in *griveaudi*. It lacks a sub-adult plumage (as *griveaudi* probably does), but in the juvenal plumage the fifth rectrix is somewhat emarginate as in continental sub-adults. It is confined to Madagascar.

Cypsiurus batasiensis (Gray)

(*h*) **C.b.batasiensis** (J. E. Gray), 1829: Calcutta, with synonym *C.b.palmarum* (J. E. Gray), 1830: Cawnpore, is a pale race with the rump paler than the back, which occurs throughout the Indian peninsula, except in the extreme north-east where it is replaced by *infumatus*, and in Ceylon. It shows clinal variation, being darkest in Ceylon (discussed above) and palest in the north-west for which latter populations the name *palmarum* is available if it were thought desirable to separate them, which I do not.

(*i*) **C.b.infumatus** (P. L. Sclater), 1865: Banjermassing, Borneo, with synonyms *C.b.tectorum* (Jerdon), 1870: North Cachar, India, *C.b.tinus* (Swinhoe), 1870: Hainan Island, and *C.b.minusculus* (Salvadori), 1889: Burma, is darker than *batasiensis*, particularly

on the rump, which is as dark as the back, and extends from north-eastern India to southern China, Hainan, Borneo, Malaya, and, perhaps, Sumatra, from which island I have not seen material. In India I have seen material from Jalpaigurie and the Khasi Hills and an intergrade with *batasiensis* from Sylhet. Further south, from Bangladesh, I have seen material of *batasiensis* from Barigoalni, Dacca and the Sundarbans. Apparently the zone of intergradation is exceedingly narrow.

(*j*) **C.b.pallidior** (McGregor), 1905: Anao, Tarlac, Luzon, Philippines, is much paler than *infumatus*, but like it has the rump concolorous with the back, and is confined to the Philippine Islands.

(*k*) The birds of Java are intermediate in colour between *pallidior* and *infumatus*, have somewhat more deeply forked tails and slightly streaked throats, a character which does not appear in other populations of *C.batasiensis*. Since they are unnamed, I propose:

Cypsiurus batasiensis bartelsorum, subsp. nov.

Type: ♀, adult. Pangerango Preanger, Java. 22 August. M. Bartels collector. Collector's No. 1332. In the collection of the Rijksmuseum van Natuurlijke Historie, Leiden.

Description: Differs from *C.b.pallidior* (McGregor) in its longer, more deeply forked, tail, and in having the rump somewhat paler and less glossed than the back, and with darker shafts to the rump feathers. It differs from *C.b.infumatus* (Sclater) by being paler below and on the rump, and in having the throat in adult plumage very slightly streaked, thus adumbrating the condition found in *C.parvus* (Lichtenstein). The juvenal is somewhat paler than adults, lacks any streaking on the throat, and has no pale (off-white) tips to the feathers, unlike the other races of *C.batasiensis* (Gray).

Range: I have seen material of *bartelsorum* from various localities in Java in the collection at Leiden (17 specimens) and in the U.S. National Museum of Natural History in Washington (4 specimens). It is probably the form occurring in Bali, but I have not seen material from that island.

Measurements of Type: Wing 119, tail 54, tail-fork 26, delta 6, culmen 5 mm.

Remarks: I am delighted to accept the suggestion of Dr. G. F. Mees and call this race after the Bartels family who have done so much to elucidate the ornithology of Java.

FUTURE WORK

Much remains to be done to define the perimeters of the ranges of continental races in *Cypsiurus* and the zones of intergradation, if any. This applies particularly to nominate *parvus* throughout its southern boundary in northern Africa and all the boundaries of *myochrous*. Similar remarks apply to the north-eastern boundary of *batasiensis*. Further study must be given to the polytopic African race *brachypterus*. Weights are required, particularly from Asia.

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TABLE 1

Mensural data on *Cypsiurus* (millimetres and grams)

	Wing-length	Delta-length	Weight	Tail-fork
C.p.parvus				
adult ♂♂	126-136 av. (7) 130,6	24-36 av. (8) 31,68		
♀♀	122-134 av. (10) 127,5	25-34 av. (8) 29,88		
overall		24-36 (17) 30,56		
immatures overall	120-125 av. (3) 122,7	13,0-14,5 av. (3) 13,67		
overall	120-136 av. (24) 128,0			
C.p.brachypterus				
(*a*) Main range				
adult ♂♂	120-138 av. (54) 128,7	24-40 av. (47) 30,81		57
♀♀	115-135 av. (66) 126,7	24-37 av. (56) 29,37		
overall		24-40 av. (114) 29,92	12-14 av. (6) 12,67	
immature ♂♂	115-134 av. (40) 124,1	10-20 av. (39) 15,40	12	
♀♀	112-132 av. (26) 122,9	11-21 av. (25) 15,22		
overall		9-21 av. (80) 15,01		
overall	112-138 av. (219) 125,8		12-14 av. (7) 12,57	
(*b*) Haroni/Lusitu Confluence				
adult ♂	141	33		67
C.p.myochrous				
adult ♂♂	127-148 av. (45) 135,4	26-42 av. (38) 32,47	15	60-71 av. (11) 65,1
♀♀	123-141 av. (35) 132,3	23,5-40,0 av. (33) 30,62	12,5-16,3 av. (7) 14,19	55-73 av. (8) 63,9
overall		23,5-42,0 av. (78) 31,59	12,5-16,3 av. (10) 14,27	55-73 av. (20) 64,3
immature ♂♂	126-142 av. (27) 131,2	13-23 av. (24) 17,00	11-15 av. (3) 13,30	34-47 av. (25) 42,0
♀♀	124-133 av. (18) 129,3	12-25 av. (18) 16,42		36-46 av. (13) 41,2
overall		12-25 av. (44) 16,75	11,0-15,7 av. (4) 13,90	34-47 av. (41) 41,7
overall	123-148 av. (136) 132,8		11,0-16,3 av. (14) 14,16	
C.p.laemostigma				
(*a*) north of the Rovuma River				
adult ♂♂	122-135 av. (28) 127,1	21-35 av. (20) 28,43		
♀♀	119-130 av. (24) 125,0	20-32 av. (19) 26,34		
overall		20-35 av. (41) 27,26		
immature ♂♂	114-127 av. (7) 120,8	9-14 av. (7) 12,21		
♀♀	111-124 av. (4) 119,5	11-14 av. (4) 12,88		
overall		9-18 av. (12) 12,92		
overall	111-135 av. (66) 125,0		10,0-13,5 av. (19) 11,76	

(*b*) south of the Rovuma River				
adult ♂♂	129-142 av. (11) 135,8	27-42 av. (10) 33,00		62-74 av. (8) 66,3
♀♀	123-137 av. (9) 130,7	25-34 av. (8) 30,63		61-70 av. (8) 65,9
overall		25-42 av. (18) 31,94		61-74 av. (17) 65,9
immature overall	128-135 av. (2) 131,5	11,5-16,0 av. (2) 13,75		
overall	123-142 av. (22) 133,3		14,2-15,6 av. (5) 14,96	
C.p.hyphaenes				
adult ♂♂	128-142 av. (19) 135,1	26-37 av. (17) 33,21	10,0-18,1 av. (11) 13,55	74
♀♀	123-142 av. (15) 131,0	26-36 av. (10) 31,80	11,0-16,5 av. (9) 13,61	59
overall		26-37 av. (29) 32,53		
immature ♂♂	126-135 av. (7) 130,71	14,0-16,5 av. (6) 15,42	10,0-17,4 av. (5) 13,47	43 av. (2) 43
overall	123-142 av. (48) 133,4		10,0-18,1 av. (22) 13,74	
C.p.griveaudi (Benson 1960)				
♂♂	125-132 av. (5) 128,8			
♀♀	119-130 av. (7) 124,6			
C.p.gracilis				
adult ♂♂	116-132 av. (13) 124,3	26-31 av. (13) 27,62		
♀♀	119-129 av. (6) 122,3	23-25 av. (4) 24,00		
overall		23-31 av. (18) 26,83		
immature overall	118-123 av. (5) 120,4	19-21 av. (5) 20,20		
overall	116-132 av. (25) 123,0			
C.b.batasiensis (Baker 1927)				
overall	107-122	7,5-9,5 av. (5) 8,40		>28
C.b.batasiensis (Ceylon: C. W. Benson *in litt.*)				
overall	113-123 av. (8) 118,4	7-12 av. (8) 10,13		30-39 av. (8) 33,63
C.b.infumatus (Baker 1927)				
overall	113-126	3,0-8,5 av. (14) 5,50		<26
C.b.pallidior				
overall	112-119 av. (6) 115,3	3,0-5,5 av. (8) 4,06		15,5-21,0 av. (5) 18,10
C.b.bartelsorum				
adult ♂♂	116-122 av. (6) 120,3	6,5-8,0 av. (6) 7,08		21-25 av. (3) 23,33
♀♀	110-119 av. (3) 115,0	6,0-7,5 av. (7) 6,43		24
immature overall	110-116 av. (4) 113,3	3,5-5,0 av. (6) 4,25		18-25 av. (5) 21,60
overall	110-122 av. (15) 116,6			18-25 av. (10) 22,70

WING-LENGTH DELTA-LENGTH WEIGHT TAIL-FORK

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