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On *Paradoxurus hermaphroditus javanicus* (Horsfield, 1824)

THE COMMON PALM CIVET OR TODY CAT IN WESTERN JAVA

NOTES ON ITS FOOD AND FEEDING HABITS

ITS ECOLOGICAL IMPORTANCE FOR WOOD AND RURAL BIOTOPES

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Paradoxurus hermaphroditus, a species belonging to the carnivore family Viverridae, lives in an extremely large area in south-east Asia. According to POCOCK (1933, 1934), CHASEN (1940) LAURIE & HILL (1954) and ELLERMAN & MORRISON SCOTT (1951), the species is found from Kashmir in the west to the Phillipines in the east; from southern China and the Himalayas in the north to the Greater and many Lesser Sunda Islands in the south. A large number of subspecies have been described (POCOCK, 1933, 1934).

Few exact data are known about its biology, especially about its feeding habits. It is said to be omnivorous and it is known as a pest to plantations and poultry pens. HECK & HILZHEIMER in BREHM (1915: 18) say: "gehen als vollendete Nachttiere erst nach Sonnenuntergang auf Raub aus, bewegen sich dann gewandt und behende genug um kleine Säugetiere und Vögel mit Erfolg zu beschleichen und zu ergreifen, nähren sich jedoch auch, zeitweilig sogar vorzugsweise, von Früchten und können wegen ihrer Diebereien in Gärten und Pflanzungen ebenso unangenehm werden wie durch ihre Überfälle der Geflügelställe: es sind also Allesfresser." KALSHOVEN (1951: 1009) reports that the worst damage reported so far is from pineapple plantations, which may be visited by scores of the animals over an area of a few hectares. This refers to *P. h. javanicus*, the only subspecies I am familiar with. On that knowledge the following report is based. Cordial thanks are due to Prof. Dr. H. Engel and Drs. P. J. H. van Bree, both of the Zoological Museum of Amsterdam, for their valuable help and guidance.

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AREAS AND LANDSCAPES WHERE OBSERVATIONS ON *P. hermaphroditus javanicus* WERE MADE IN WESTERN JAVA.

- (I) The rain forest of the twin volcano Pangarango-Gedè and its surrounding plantation-covered (tea and cinchona) foothills.
- (II) The cultivated hilly lowlands between Bandung and Bogor.
- (III) The rain forest of the volcanic ranges North and South of the Plateau of Bandung.
- (IV) The young-tertiary ranges covered with virgin and secondary woods stretching about 150 kilometers along the South coast from Tjilamereun to Tjisolok.
- (V) The flatlands interspersed with small patches of wood in the Western part of the Plain of Djakarta, roughly between Bogor and Rankasbetung.
- (VI) The wooded swamps of the Tjitanduj-estuary and Sěgoro Anakan and adjacent territories along the South coast.

In total some 5,000 square kilometers, with altitudes varying from sea level up to 3,000 meters.

PERIOD OF OBSERVATION

My observations cover a period from 1910 to 1942. For almost 50 years my family was actively committed to field-biological work, mainly ornithology, in the uncultivated regions listed above and in other areas on the island of Java. As a field-biologist and a hunter I was keenly interested in all aspects of zoology and botany. Thus tracks, excrements, feeding patterns, tooth-marks, chips or parings, noises and smells and the like belonged to the bits of information habitually noted.

The list of food plants contains the latin names (taken from HEINE, 1950) of the plants of which I still remember the Sundanese name. This is but a minority of all the species of fruits and seeds I actually found. I did not then systematically list my findings, nor the number of droppings inspected, which must easily exceed a few hundred over the period 1931/1942.

FOOD PREFERENCES, EATING HABITS, IMMUNITY TO PLANT POISONS

The only safe method to get exact information on the food of a nocturnal animal is to inspect its faeces or investigate the stomach contents. We killed but a few of the Tody Cats and did not inspect the stomach contents.

Its fruit consumption is strictly confined to berries and pulpy — though not necessarily juicy — fruits, including those of *Ficus* trees and palms. Nuts are not touched.

It must be noted that I do not know the names of many seeds I was familiar with. Of some I do not now remember the Sundanese name and also there were many seeds I did not know at all.

My observations convinced me that *Paradoxurus* only takes really ripe fruit. It picks the fruits with painstaking care, apparently leaving the less ripe ones for the following night. *P. h. javanicus* chews very carefully, rather

hesitantly, never hurriedly or voraciously. Its dental system does not point to a carnivorous diet. It does not remove the seeds. Except for such big fruits as pineapples and, very likely, also breadfruits (*Arctocarpus* spp.) and papaw (*Carica papaya*) the animal, after chewing swallows the whole munched fruit. It may stay for a full night in the same tree if food is ample, to get a fill.

List of some plants of which the fruits are eaten by the Javanese Tody Cat

TREES			PALMS		
<i>Achras zapota</i> Linn.	1		<i>Arenga obtusifolia</i> Mart.	1	
<i>Antidesma bunius</i> Linn.	1		„ <i>pinnata</i> Merr.	1, 3, 4	
<i>Eugenia polycephalla</i> Miq.	1	(36)	<i>Caryota mitis</i> Lour.	1	
<i>Ficus alba</i> Reinw.	4	(55)	„ <i>Rumphiana</i> Mart.	1	
„ <i>fistulosa</i> Reinw.	1		<i>Daemonorops melanochaetes</i>		
„ <i>fulvus</i> Reinw.	4			Bl. 1, 3	(32)
„ <i>ribes</i> Reinw.	1		<i>Pinanga Kuhli</i> Bl.	1, 3	
„ <i>toxicaria</i> Linn.	4		<i>Plectocomia elongata</i> Bl.	1	
„ <i>variegata</i> Bl.	4		Several <i>Calamus</i> species	1	(70)
<i>Garcinia dioica</i> Bl.	1				
<i>Litsea zebifera</i> Bl.	1, 4				
<i>Semecarpus heterophylla</i> Bl.	1, 3				
HERBS			SHRUBS, CREEPERS		
<i>Ananas comosus</i> Merr.	1		<i>Coffea</i> species	1	
<i>Hornsteadtia</i> species	1		<i>Cyphonandra betacea</i> Sendt.	1	
<i>Musa zebrina</i> v. Houtte	1		<i>Lantana camara</i> Linn.	1, 2	
<i>Pandanus cariocus</i> Kurz	1	(26)	<i>Melastoma</i> species	1	
„ <i>tectorius</i> Sol.	1, 3		<i>Physalis angulata</i> Linn.	1, 2	
			<i>Rubus moluccanus</i> Linn.	1	
			<i>Smilax macrocarpa</i> Bl.	1	(5)
			<i>Solanum nigrum</i> Linn.	1	
			<i>Solanum torvum</i> Swartz	1, 2	
			<i>Vitis</i> species	1	(32)

Note: Identification was done with the aid of:

- Recognizable seeds in faeces marked: 1
- Recognizable seeds and peels in faeces „ : 2
- Seedlings sprouting from old droppings „ : 3
- Actual observation of the Tody Cat in the trees „ : 4

The figures between brackets behind a name indicate the number of species and sub-species of the genus listed by HEINE (1950) as occurring in the Indonesian Archipelago.

The digestive system apparently is immune to many plant poisons which irritate the human digestive tract. Such irritants occur, e.g. as crystalline needlelets, in many fruits; those from *Arenga pinnata* fruits cause severe swellings of the human mucous membrane, which may lead to suffocation through swelling of the throat. Another example is the sap of the upas tree (*Semecarpus heterophylla*), that causes festering wounds on the skin of most humans, as I know from personal experience.

The intestinal tract offers easy passage to — undamaged — seeds measuring up to three quarters of an inch in diameter and over an inch in length.

About the alleged carnivorous habits of this animal I have no facts to report. As we inspected the faeces without a magnifying glass it is impossible to say with certainty that no traces of carnal food, such as crushed scales, have been present. The animals perhaps may have taken grubs, pupae, soft bellied things and shell-less snails, birds eggs, chickens, or young rats from the nest. But bigger game may most probably be excluded. Meat will not show in visible traces in the excrements, but hairs, feathers and bones will, and I do not remember having seen such remains. However, due to its nocturnal life and probably because it sometimes "pilfers a chicken pen" as folklore has it, it is branded a carnivorous marauder or just a pest. This is the reason why it is killed on sight; it explains also why it has not been legally protected in Java.

The Sundanese in West Java call it 'Tjareuh' — or when they want to be specific 'Tjareuh Bulan'. Unfortunately tjareuh also applies to all other kinds of small carnivores, such as *Felis bengalensis*, *Helictis orientalis*, *Viverricula malaccensis*, and sometimes even to *Amblonyx cinerea*. This carelessness in distinguishing these different animals is detrimental to the Tody Cat as it happens to carry scent glands in the groin, which spread a pungent smell over great distances, impressing its presence and image on the minds of the people. Whenever a marauder takes something, the natives, no matter whether they actually smelled it or not, will, in most instances settle the case with the stereotype remark: "Ku tjareuh" (by tjareuh) in their minds specifically blaming the Tody Cat. As such a thievery is almost never witnessed by anybody, there is no proof. It even gets the blame for any fruit robbed — or partly eaten — by fruit bats or rodents, and for all the fowl killed by *Herpestes javanicus* or *Helictus orientalis* in broad daylight. Most people hardly know any other noxious carnivores but the Tody Cat. It is curious that it are not so much the fruit thieveries, but the alleged chicken thefts (mostly occurring in untended backyards) that make people kill the Tody Cats. The fruit thieveries are either not noticed, or taken rather philosophically.

Considering the specialized anatomy of *Paradoxurus* it is not probable that a plantigrade animal has the ability to make a dashing assault as we know from real carnivores. It is not equipped with sharp retractable claws. Its whole behaviour is rather restrained, not stealthy as in carnivores. It does not have the sharp, pointed molars we find even in the non-feline ones. Its molars are a cross between these and the knobbed ones of the Primates, they are rather blunt. An outstanding point is its highly specialized intestinal tract.

For these reasons I do not believe that this animal with such specialized scansorial habits can hold any sizable prey that struggles for its freedom if it manages to grab it. This however does not apply to such animal delicacies which can not dash off or which are too young for defense.

Obviously people never complain about its "atrocities" in the jungle, but only about such which he is suspected of doing around the settlements. Important in this relation may be some of my personal reminiscences.

About 1917, at Pasir Datar estate a goose was found dead in the chicken pen early in the morning. The chickens roosted on sticks about 3 meters off

the ground. The geese stayed below. The dead goose had its whole neck bloody and raw and featherless. Everybody claimed that a Tody Cat had done it. There was no proof. Though enough Tody Cats frequented the fruit trees on the premises, this was the only instance of a marauder breaking into my chicken pen during the 30 odd years I lived in Tody Cat territory. To me it sounds rather improbable that an animal so cautious will deliberately force its way into structures giving off human smell.

Another recollection is from Bantam, near Rankasbëtung. We were camping at the outskirts of a kampong near the rain forest border on the Gunung Karang in 1934. For a week we descended every night upon the kampongs for a special investigation on fruit bats and small flying squirrels. Every night, without exception, we came across some Tody Cats in Aren palms and in fruit trees. Almost everybody there had a sloppily built chicken pen, with fowl. People never complained about chickens being robbed by Tody Cats. I now regret that we never killed one to inspect its stomach contents.

Nevertheless in written and auricular tradition the Tody Cats' bad reputation stands as a constant menace to its life.

HOW THE ANIMAL GETS AT ITS FOOD

Smell. No experiments are extant, as far as I know, to prove the acuteness of its smell. Yet, from observations made in the jungle and around plantation centres I am inclined to assume that the organ of smell is extremely acute and most selective, with the emphasis on selectivity.

Climbing capability. "They differ essentially from the Civet Cats or Viverinae . . . in being short-legged, more plantigrade species, adapted to scansorial habits with well developed pads behind the plantar pad on the feet for grasping the branches of trees after the manner of bears" (POCOCK, 1933 : 855). The climbing ability is phenomenal. The animal scales the naked trunks of trees and palms. One may see it feel its way across a liana spanning a gorge, or picking fruits from twigs which, through the animal's weight are strained to — or seemingly beyond — their breaking point, as if it is grandly indifferent about the risk of a sheer drop. It will get at the ripe berries which it has detected, even if that would mean making a detour over several trees or through ravines, or what other obstacles stand in the way. No tree seems to be too high, no twigs too fragile, almost no vine too weak. If hopelessly crowded at the end of a branch the animals may come sailing down and land smack on the belly with a sickening thud, and dash off with perplexing vigour and baffling speed.

Especially in the dry season we observed rub-tracks at the foot of *Ficus* trees, which we explained as having been made by our Tody Cats in cleaning their foot-soles from the sticky juice leaking out of the tiny nail-punctures they had made in the bark.

HOW THE TODY CAT DEFECATES

As can be deduced from the observations, in the stomach and (or) in the intestinal tract the following takes place:

- (1) All the pulp is separated from the seed, without any damage to the latter. Even such tender kernels as *Ficus* and *Solanaceae* seeds generally pass without being cracked.
- (2) Seeds retain their germinative power.
- (3) It seems to me that the shells of hard seeds or stones, may be cleaned and perhaps more or less eroded on the surface, so that the stone, after excretion, is capable of absorbing water and, in so doing can germinate¹⁾.

Defecation habits. In 1934 I kept a nearly half-grown Tody Cat in captivity. It slept in a basket in a darkened corner of my office at Situ-Gunung, W. Java. About 210 cm over the floor was an about 12.5 cm wide cornice nailed on the wall. My Tody Cat was never observed to defecate on the floor of my office. One evening I suddenly saw him on the cornice, indulging in most alarming antics, like doubling up its back, twisting the tail with odd jerks and so on. After a few minutes he let go walking and then clambered down, looking the most satisfied fellow on earth.

Why did he do so on that yet unfurnished cornice (we hadn't placed any objets d'art on it yet) and never on the floor?

Discussing this phenomenon with my late brother, Dr. Max Bartels, we got a new idea about a fact we were both familiar with, namely that excrements of Tody Cats are found strung out on slim bridges, on fallen trees in the wood, or on such spanning a brook or rivulet; on naked tree branches high above ground, unseen from below, but well discernable from the crown of the trees we climbed for collecting birds eggs. The faeces almost invariably were deposited strung lengthwise, and not coiled in a heap. This makes it so easy to distinguish them from all other excrements. The shape is very typical for the species, as the Tody Cat keeps going while relieving itself. The faeces usually are not roundish in cross-section, mostly they are flattened, often jellylike. My young Tody Cat attracted our attention to these peculiar facts, and also to another — and more momentous habit of his kin.

¹⁾ This for instance is apparently true for *Arenga pinnata*. In Java one sees no regular plantations of this for the rural economy most important sugar palm. These palms grow hither and thither, obviously standing on the spot where the seeds were excreted or where they got arrested after having been displaced by rainwater. Planting the seeds taken simply from ripe fruits is not done. DE BIE (quoted in HEINE, 1950: 384) says that the Javanese have objections against planting these seeds, based on superstition. In the Tobalake area, in N-Sumatra planting the seeds is generally practised, he states. Unfortunately he does not say whether the seeds were picked from easily accessible Tody Cat faeces on the soil or from the fruit-batches in the palm-tree tops!

to wit: the Tody Cats seem to prefer open spots for defecating. TICKELL (BREHM et al., 1915 : 19) is quoted to report: "... verrät er seine Anwesenheit durch die Lösung, die er auf niedergebroschenen Stämmen abzulegen liebt"; Junghuhn, cited on the same page, reports another preferred spot: "sieht man oft auf dem Boden der Wege, von denen der Kaffeegarten geradlinig und kreuzweise durchschnitten wird, sonderbare, weiszliche Kotklumpen eines Tieres liegen, die ganz und gar aus zusammengebackenen, übrigens aber unbeschädigten Kaffeebohnen bestehen". Thus Junghuhn observed two significant facts almost a century ago, the dung was deposited on the roads and the seeds were undamaged²⁾.

My young Tody Cat's performance lead my brother, Dr. Max Bartels, to watch an open spot after midnight by full moon in 1936. He reported having seen a Tody Cat coming out of the inky blackness of the jungle and act quite similarly, including the strange contortions. It must have come purposely to that open spot for relieving itself. Since then we remained on the alert to see whether Tody Cat excrements were found off the paths, as far as they existed, in the wilderness. Having criss-crossed for hundreds of miles through all type of jungle, leaving paths and tracks, in the pursuit of biological work and collecting, I may state that I do not remember ever having seen the droppings deposited just at random on the soil in the woods. Of course in dense jungle they might easily escape attention. One might reason: no excrements — no Tody Cats. But Tody Cats there were, sure enough. Whenever a fallen tree or a thick liana happened to span a brook, they bore the telltale droppings. Likewise on roads, or footpaths one will find them, by preference on the bare soil and not on the fallen leaves. One will find them on earthslides, often within 48 hours after their coming into being, on protruding rocks in the streambed of rivers, on top of rocky ridges, on borderpaths along clearings or plantations, especially where a footpath forks off into the bordering jungle.

Distance the Tody Cats carry the seeds. Through an unique coincidence I found how far away from the feeding ground the droppings can be deposited. I owned a small pineapple-grove on the tea estate of Tjibuni, Mnt. Patuha, W-Java, planted with "Cevenne-pineapple" hybrid; the altitude was 1350 m. For many kilometers around nobody else had pineapples, simply because the native varieties did not bear fruit at that altitude. In 1931/1932 I found Tody Cat droppings with tufts of pineapple fibres as far as 3 kilometers (as the crow flies) away from my pineapple-grove.

EYESIGHT

I have no reason to assume that the eyesight is better than just good. The reflection of the eyes in torchlight is pale green.

²⁾ Such coffeebeans were collected, washed, dried and finally exported under the name of "Luak-Coffee". It was sold at higher, sometimes much higher prices than first class handpicked coffee-beans. It was generally accepted that they had a better taste. KALSHOVEN (1950 : 1009), disclaims this.

ACTIVITY RHYTHM

My brother, Dr. Max Bartels, possessed a tame, almost adult Tody Cat which he kept in his bedroom. It used to leave every evening after the sun was down, and scratched on the door the next morning some ten minutes before sunrise to be let in. My brother kept it a few months and during that period it never deviated from this strict time-schedule. In the thirty years of my field-biological work I have but once seen a Tody Cat at daytime which had not obviously been flushed from its lair. That was in a remote rain forest on the Halimun in 1922.

THE WAY THE TODY CAT HOLDS ITS TAIL

When on the go, on the ground or over branches, the Tody Cat will hold its tail stiffly stretched and keep it scrupulously an inch or two off the ground or the branch. This is in striking contrast to the way it is usually depicted.

SUMMARY

In and around wooded areas *P. h. javanicus* feeds almost entirely on berries and pulpy fruits, perhaps rarely on small, slow animals. It does not damage the seeds it swallows and which it deposits later, up to a few kilometers from the tree wherefrom it took the fruit. The deposited seeds are fully germinable and cleansed of the adhering fruit meat, thus preventing possible destruction of the germ through moulds. Notably for some palm seeds — such as those of the sugar palm — passage through the Tody Cat's intestinal tract seems necessary for rendering them germinable. A typical habit seems to be its accomplishing an auto-peristaltic movement whenever it arrives at an open spot, a fresh earthslide or the like. Right here it prefers to deposit its droppings and in so doing start reforestation.

For many seeds it is the only agent performing this service. Its usefulness in this respect is hardly known, much less appreciated and honoured.

Its alleged rapacity as to poultry is definitely exaggerated, probably false, and certainly needs scientific investigation and proof. The quantity of consumption-fruit it takes from man-owned fruit trees must be considered trivial as compared to what other animals take, and for which it is too often blamed.

The evidence available strongly supports the desirability to protect *Paradoxurus hermaphroditus javanicus* against indiscriminate killing.

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