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Occurrence of *Idiosepius pygmaeus* (Cephalopoda, Idiosepiidae) in Indonesian waters

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Abstract

Individuals of *I. pygmaeus* STEENSTRUP, 1881 have been rediscovered after more than 70 years at the type locality of *I. pygmaeus hebereri* GRIMPE, 1931 in Lombok, Indonesia. Occurrence of the animals between a flotsam of garbage indicates the ability to adapt to new habitats.

Key words: Cephalopoda, Distribution, Idiosepiidae, *Idiosepius pygmaeus*, Indonesia

Introduction

Idiosepiidae are represented by a single genus with seven currently valid species, *Idiosepius biserialis* VOSS, 1962, *I. macrocheir* VOSS, 1962, *I. notoides* BERRY, 1921, *I. paradoxus* (ORTMANN, 1888), *I. picteti* (JOUBIN, 1894), *I. pygmaeus* STEENSTRUP, 1881, *I. thailandicus* CHOTIYAPUTTA, OKUTANI & CHAITIAMVONG, 1991 (for a review see VON BOLETZKY & al. 2005). Their distribution stretches from Russia, Japan, the Indo-Pacific region to Tasmania as well as Moçambique (APPELLÖF 1898; SASAKI 1914; YAMAMOTO 1942; VOSS 1962; OKUTANI 1973; LI 1983; LU & PHILLIPS 1985; NATEEWATHANA 1997; NESIS & al. 2002; VON BYERN & al. 2005). One conspicuous morphological character of this genus is the adhesive organ located on the posterior part of the dorsal mantle side. This is used for attachment during the day to the lower leaf surfaces of sea grass or algae for camouflage.

In 1927, B. Rensch collected 14 specimens of the genus *Idiosepius* at Ekas Bay, Lombok, Indonesia. GRIMPE (1931) compared the collected material with samples of *I. pygmaeus* STEENSTRUP, 1881 from several institutions: the Kobenhavns Universitet, Zoologisk Museum, Copenhagen, Denmark; Zoologisches Museum, Universität Hamburg, Germany (collected in the Banda Sea); Naturmuseum und Forschungsinstitut Senckenberg, Frankfurt/Main, Germany (collected in Ternate); Nationaal Natuurhistorisch Museum Leiden (collected in Sibolga, NW-Sumatra); and the Zoologisch Museum, Universiteit van Amsterdam, Amsterdam, The Netherlands (collected in Balikpappan, SE-Borneo). He had no access to the type material of *I. paradoxus* (ORTMANN, 1888), *I. picteti* (JOUBIN, 1894) or *I. notoides* BERRY, 1921; those comparisons were made based only on the literature.

His specimens differ from *I. pygmaeus* and the other species mostly in size, contour of the adhesive organ and expression of the hectocotylus (GRIMPE 1931). He therefore

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regarded his specimens as the subspecies *Idiosepius pygmaeus hebereri*. Moreover, he proposed to separate the species *I. pygmaeus* into three subspecies: *I. pygmaeus pygmaeus* (currently *I. pygmaeus*) in the central Indian Ocean, *I. pygmaeus paradoxus* (currently *I. paradoxus*) as a northern variation and *I. pygmaeus hebereri* as a southern variation. Since *I. pygmaeus* was found in Australian waters (JACKSON 1992, 1993), this proposal is considered no longer valid.

Examinations by NESIS (1982) revealed that the morphological characteristics were not sufficiently different to justify the subspecies; *Idiosepius pygmaeus hebereri* was therefore referred to *I. pygmaeus*.

The present study provides morphological data on *Idiosepius pygmaeus* from Indonesia and Thailand and yields insights into the habitat conditions of Indonesian individuals.

Abbreviations

TL	Total length
ML	Mantle length
MW	Mantle width
MWI	Mantle width index
NHMW	Natural History Museum in Vienna, Austria
ZMB	Zoologisches Museum, Museum für Naturkunde der Humboldt-Universität, Institut für Systematische Zoologie, Berlin, Germany

Material and methods

Material: 46 males and 3 females were taken from the surface by a dip net between 30 April and 7 May 2004 in the eastern part of Ekas Bay, Lombok Island, Indonesia (08°52.020'S; 116°27.541'E). Water values (taken on 4 May 2004) were as follows: oxygen content 83.7% (6.34 mg/l), salinity 34.4, temperature 29.1 °C.

Part of the material was deposited in ZMB (2 males ZMB 110.203-110.203, 1 female ZMB 110.205) and NHMW (3 males NHMW 103223-103225).

For comparison, the types of *Idiosepius pygmaeus hebereri* GRIMPE, 1931 (Ekas Bay, Lombok, Indonesia, Rensch coll., ZMB Moll. 86118a-b and ZMB Moll. 86119a-c) were studied.

In addition, specimens of *I. pygmaeus* captured in April 2004 in the mangrove river Klong Mudong, Phuket Island, Thailand (7°48.107'N; 98°24.472'E) were investigated.

The body measurements include total length, mantle length, mantle width and wet weight (ROPER & VOSS 1983). All specimens were anaesthetized in 3% ethanol, measured and fixed in 70% ethanol. All suckers on the hectocotyli were counted under a stereomicroscope. Absent suckers were counted if residual structures such as sucker shafts were visible.

Habitat: The large Ekas Bay is almost closed off from the sea, with a small passage for water exchange in the southern part. No information is available on the northern or western part of the bay, which is relatively inaccessible. In the eastern part along the coast, mangrove forests (*Rhizophora* sp. and *Avicenna* sp.) alternate with sandy areas.

Fig. 1: Collection site at Ekas Bay, Lombok. The specimens can be observed and caught in the zone between mangrove forests and rocky coastline. In front, flotsam covers the water surface between the rocks. During low tide the collection site and the mangrove forest fall dry.

The shore is submerged at high tide (which changes its flow direction every 6-7 h) and falls dry at low tide.

Rensch (in GRIMPE 1931) found his specimens directly in front of the mangrove forest in small pools with muddy sediment and amongst the mangrove roots (*Sonneratia* sp.). We caught our specimens in an area between the mangrove forest (*Avicenna* sp.) and the rocky coastline (Fig. 1). This small zone (width about 20 m, length about 50 m) is sandy and lacks vegetation. North and south of this area the beach is sandy. No individuals were detected between the mangrove roots or on the sandy bottom. The collection site and mangrove forest are submerged at high tide (to about 1.2 m high) and fall dry at low tide. During high tide, garbage, leaves and other plant material are transported here by the current. On some days this flotsam covers almost the whole water surface; this differs from all known habitat conditions of cephalopods and in particular of pygmy squids. Interestingly, *I. pygmaeus* was detected here, caught in high numbers within or below the flotsam.

Our observations on the behaviour of *I. pygmaeus* at Lombok agree with that described by MOYNIHAN (1983) and SUWANMALA & al. (2005). The garbage in the water apparently does not affect *I. pygmaeus*, and the animals were also observed to mate within this flotsam. Even compact and strongly agitated waste had no influence on their

Table 1: Mean value and standard deviation (SD) of total length, mantle length, mantle width and mantle width index of *I. pygmaeus* in Thailand and Indonesia.

	TL [mm]		ML [mm]		MWI		MW [mm]	
	mean	SD	mean	SD	mean	SD	mean	SD
Thailand								
females (n = 15)	29.77	2.7	17.97	4.04	48.40	6.33	8.53	1.14
males (n = 89)	20.65	2.68	11.58	1.19	43.40	5	5.01	0.65
Indonesia								
females (n = 2)	27.25	4.6	15.5	2.12	47.90	7.13	7.5	2.12
males (n = 46)	19.24	2.4	11.53	1.28	47.82	6.12	5.49	0.7

Table 2: *Idiosepius pygmaeus*, variation of suckers on the left (L) and right (R) hectocotylized arm in ventral view.

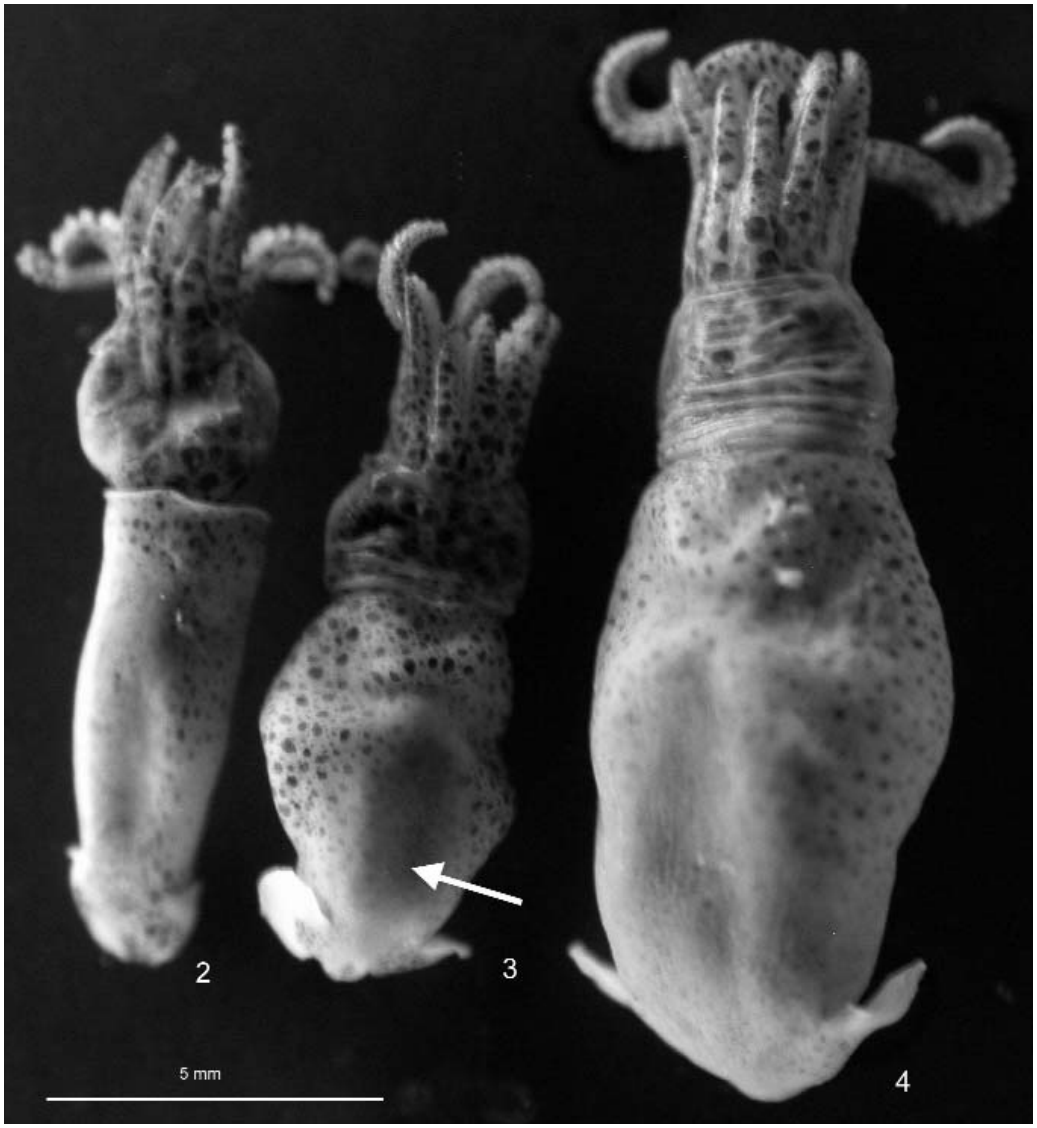
	Thailand	Indonesia
L/R	n = 64	n = 46
not counted	-	6
0/0	1	-
1/1	2	1
1/3	1	-
2/2	5	6
2/3	21	11
2/4	1	-
3/2	-	4
3/3	24	13
3/4	7	4
4/3	1	-
4/4	1	1

behaviour and movement. Usually, they stick to all kinds of dark waste or plant material for camouflage when threatened by predators or when lying in wait for prey swimming by. When threatened, they escape under the waste.

The occurrence of the animals in high numbers indicates that the species is not endangered. The local fishermen, living 2 km away, were unaware of their existence and showed no interest in catching such a small, unprofitable cephalopod species. This species should therefore remain available for further studies, in particular at its location during low tide.

Results

Description: The morphology of the body and the presence of an adhesive organ clearly place the specimens (Fig. 2, 3) into the genus *Idiosepius* (NESIS 1982). The animals are small (Fig. 2, 3 and Table 1); their mantle is elongate, tapering and rounded at the posterior end. The fins are small and oval to almost round. The body is spotted with reddish brown chromatophores. The mean mantle lengths of the animals from Indonesia



Figs 2 - 4: *Idiosepius pygmaeus*. 2: Dorsal view on the deformed male specimen (NHMW 103225). 3: Male specimen from Indonesia with its adhesive organ (arrow) on the posterior part of the dorsal mantle. 4: Female specimen from Indonesia.

were 15.5 mm (females) and 11.57 mm in males (Table 1), similar to specimens from Thailand (females 17.97 ± 4.04 mm and males 11.58 ± 1.19 mm), while *Idiosepius pygmaeus hebereri* of GRIMPE (1931) are smaller with a mean mantle length of 14.5 mm in females and 8.5 mm in males.

Morphologically, the species of *Idiosepius* are characterized by the arrangement of suckers on the club (two or four rows) and by the number of suckers on the ventral arms (hectocotyli). GRIMPE (1931) did not describe the number of sucker rows on the club,

but re-examination by the first author of the type material of *I. pygmaeus hebereri* verifies the presence of four rows. Its ventral arms bear 3 suckers at the base of the left and 2 suckers at the base of the right, shorter and broader extremity. The specimens of *I. pygmaeus* from Indonesia and Thailand bear different numbers of suckers in various combinations on both ventral arms (Table 2).

One non-anaesthetized specimen from Indonesia (NHMW 103225) was placed directly into the fixative solution, deforming the body (Fig. 4). The internal anatomy and form of the adhesive organ was not investigated.

Discussion

A species characterization based on mantle size is less appropriate for this genus; factors like environment, time of spawning, temperature and season of collection strongly influence growth. Mantle length can be used to distinguish sexes in individuals from a selected area and specific period, but not to characterise species. Moreover, considerable changes in mantle size and morphology under anaesthesia and after fixation underline the difficulties of a clear species characterization using this feature.

A classification based on the number of suckers on the ventral arms in males casts doubt on the usefulness of this criterion for species identification. The cause and function of the sucker variations on both ventral arms, which have also been observed in *I. paradoxus* (ORTMANN, 1888) and other species (VON BYERN & KLEPAL 2006), are still not understood and do not enable a clear distinction of species. Furthermore, a female characterization using this systematic key is impossible.

The occurrence and behavioural pattern of specimens within this flotsam indicates that *Idiosepius pygmaeus* is adaptable to "unusual" habitat conditions. Moreover, its distribution pattern is still unexplored. To date, specimens could only be caught at high tide in Ekas Bay. Additional investigations at different sites within and outside the bay are necessary to determine its location during low tide.

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