Chiropsella bart n. sp., a new box jellyfish (Cnidaria: Cubozoa: Chirodropida) from the Northern Territory, Australia

LISA-ANN GERSHWIN[1] AND PHILIP ALDERSLADE[2]

[1]*School of Marine Biology and Aquaculture, James Cook University, Townsville QLD 4811*
and
Australian Institute of Marine Science, Townsville QLD 4810, AUSTRALIA
lisa.gershwin@jcu.edu.au.
Current address: National Marine Stinger Advisor, Surf Life Saving,
18 Manning Street, South Brisbane QLD 4101, AUSTRALIA
[2]*Museum and Art Gallery of the Northern Territory, GPO Box 4646, Darwin NT 0801, AUSTRALIA*
phil.alderslade@nt.gov.au.

ABSTRACT

A new species of multi-tentacled box jellyfish from eastern Arnhem Land along the Gulf of Carpentaria, renowned locally for occurring only in the so-called 'safe season' (i.e., the dry season), is described. *Chiropsella bart* n. sp., differs from other chiropsalmids in maturing at a much smaller size, in its mature tentacle number, in having coalesced gastric saccules in the form of a kidney-bean-shaped knob, and in having very long pedalia with the branches and tentacles clustered near the distal end.

KEYWORDS: taxonomy, Cnidaria, Coelenterata, Chiropsalmidae, Chirodropidae, *Chiropsalmus*, stinger season, Gulf of Carpentaria.

INTRODUCTION

Box jellyfishes in Australia have long been a concern, with at least 70 deaths attributed to *Chironex fleckeri* Southcott (Currie and Jacups 2005). The Chirodropida (i.e., the multi-tentacled box jellyfishes) of Australia have been grouped into only two species, *Chironex fleckeri* and *Chiropsalmus quadrigatus* Haeckel (Cleland and Southcott 1965; Barnes 1965, 1966; Keen 1971; Freeman and Turner 1972; Brown 1973; Fenner 1986; Sutherland 2001). Recent authors have separated the Australian species of *Chiropsalmus* from the true Burmese *Chiropsalmus quadrigatus*, but have still not commented on morphological diversity in the genus around Australia, implying that the regional forms are all the same species (Edmonds 1975; Williamson *et al.* 1996; Carrette *et al.* 2002; Gordon *et al.* 2004), similar to the assumptions made for *Chironex* (Williamson *et al.* 1996; Carrette *et al.* 2002; Currie *et al.* 2002). In fact, recent morphological and molecular analyses of Australian Chirodropida (Gershwin 2005) have indicated considerable diversity in the group, with at least five species comprising what is currently known as *Chironex fleckeri* and at least two species recognised interchangeably as *Chiropsalmus* sp. or *Chiropsalmus quadrigatus*.

The common '*Chiropsalmus*' from northern Queensland was recently described as a new genus and species, *Chiropsella bronzie* (Gershwin 2006a). *Chiropsella* differs from *Chiropsalmus* in having sessile, solid gastric saccules and lacking exumbrellar nematocysts.

A peculiar chiropsalmid from the Gove Peninsula in eastern Arnhem Land was reported by Currie *et al.* (2002). This medusa matures at a much smaller size than is typical for most species of Chirodropida, and normally occurs only during the local dry season, in contrast to all other known species in the Chirodropida, which are predominantly wet season or summertime species. This 'Gove chirodropid', as it is commonly known, is similar to, but distinct from, the Queensland *Chiropsella bronzie*. The purpose of this paper is to describe this new species of chiropsalmid from Arnhem Land. This species is not known to be harmful to humans, aside from a localised painful sting.

MATERIALS AND METHODS

All specimens except the holotype were caught during routine netting operations off the Gove Peninsula Surf Life Saving Club, and forwarded to the Museum and Art Gallery of the Northern Territory (NTM) for identification; the holotype was caught independently and donated by R. Hartwick. All measurements and character assessments were thus made on preserved material. Measurements were made with Max-Cal digital calipers to the nearest 0.01 mm. Bell height (BH) was measured from the apex of the bell to the velarial turnover. Diagonal bell width (DBW) was measured across diagonal pedalia on a flattened specimen,

at the height where the pedalium joins the exumbrella of the bell. Interrhopalial width (IRW) was measured between adjacent rhopalia, with the specimen flattened. Tentacle base width (TBW) was measured at the uppermost part of the tentacle, immediately below the pedalium; if the tentacle was flattened, width was measured across the widest points. Sex was determined, when possible, by biopsy. Female gonads have obvious ova; male gonads have a conspicuous 'finger-print' appearance of many fine more-or-less parallel lines. Nematocysts were examined and measured with a Leica DMLB compound microscope and Leica IM-50 Image Manager v. 1.20 for Windows; all observations and photographs were made through a 40x objective (i.e., 400x magnification). Nematocysts were identified following the keys of Calder (1974), Mariscal (1971), and Williamson *et al.* (1996), as elucidated in Gershwin (2006b).

SYSTEMATIC RESULTS

Class Cubozoa Werner, 1973
Order Chirodropida Werner, 1984
Family Chiropsalmidae Thiel, 1936
(*sensu* Gershwin 2006a)
Genus *Chiropsella* Gershwin, 2006
Chiropsella bart n. sp.

(Figs 1–4)

Chiropsalmus sp. Currie, 1992: 1–2.

Gove chirodropid Currie *et al.*, 2002: 649. – Currie and Jacups 2005: 631–636.

Chiropsalmus n. sp. B Gershwin, 2005: 125–126, pl. 4.9C, and throughout; Gershwin 2006b: 12; pl. 28; cnidome.

Chiropsella n. sp. Gershwin, 2006a: 25, 36; Table 1; comparison with *C. bronzie*.

Material examined. HOLOTYPE – NTM C15252, Town Beach, Nhulunbuy, Gove Peninsula, NT, coll. P. Schelle and R. Hartwick, 17 May 1986; BH 47.89, DBW 62.03, IRW 30.34, TBW 1.42, 5-tentacle stage on all 4 pedalia, male.

Other material. PARATYPES: NTM C14603, Nhulunbuy, Gove Peninsula, N.T., coll. Surf Life Savers, 6 October 2002, BH 44.81, DBW 62.91, IRW 33.98, TBW 1.76, 5-tentacle stage on all 4 pedalia, mature male; NTM C14601, Nhulunbuy, Gove Peninsula, N.T., coll. Surf Life Savers, 27 April 2002, BH 51.05, DBW 76.08, IRW 37.28, TBW 1.37, 5-tentacle stage, sprouting the 6th on the one intact pedalium, gravid female; NTM C14602, same loc. data as NTM C14601, BH 43.92, DBW 68.54, IRW 34.77, TBW 1.44, 5-tentacle stage on all 4 pedalia, gravid female; NTM C14604, same loc. data as C14603, BH 33.05, DBW 46.40, IRW 24.11, TBW 1.00, 5-tentacle stage on all 4 pedalia, gravid female; NTM C14605, same loc. data as C14603, BH 16.39, DBW 27.03, IRW 12.16, TBW 0.73, 4-tentacle stage, sprouting a 5th on one pedalium, immature; NTM C11046, Nhulunbuy Town Beach, Gove Peninsula, N.T., coll. Surf Life Savers, 2 June 1991, 3 specimens BH 45-50.

Diagnosis. *Chiropsella* species reaching about 5 cm BH with up to about 5 tentacles per pedalium; with long scalpel-like pedalia with main tentacles forming a more or less terminal cluster; with volcano-shaped diverticulum on pedalial canal near pedalial base; with coalesced solid, knob-like gastric saccules, appearing as single kidney-bean-shaped structure.

Description. Body small, with mature gonads at about 3 cm, reaching known maximum of about 5 cm BH, strongly cuboid (Fig. 1). Body mesoglea thick and relatively solid, with thickened and stiff apical dome and interradial pillars; with shallow sub-apical coronal furrow and well-defined interradial and adradial furrows. Adradial furrows extend laterally at level of stomach, forming a well-defined rectangular perradial region. Exumbrellar surface smooth, lacking nematocyst warts or freckles.

Pedalia (Fig. 2A) long, scalpel-shaped, with pronounced adaxial keel reminiscent of structure of carybdeids; abaxial tentacle issuing distally well past halfway point; remaining fingers and tentacles arranged close together more or less terminally, but opposite rather than alternate. Pedalial canal flattened in cross section, with a volcano-shaped upward-pointing diverticulum near base. Sub-terminally, pedalial canal bifurcated, with each leg giving rise to branches on its own side only (Fig. 2B). Pedalial canals straight at tentacle insertion.

Tentacles up to 5 per pedalium in present collection, with one specimen having a 6th nub; round and very fine in cross section; straight at base. Banding pattern could

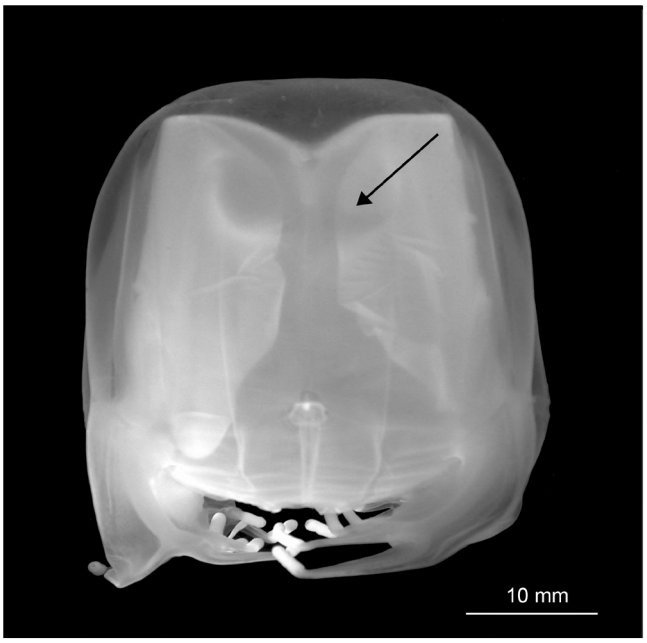

Fig. 1. *Chiropsalmus bart* n. sp. holotype; note coalesced gastric saccules (arrow).

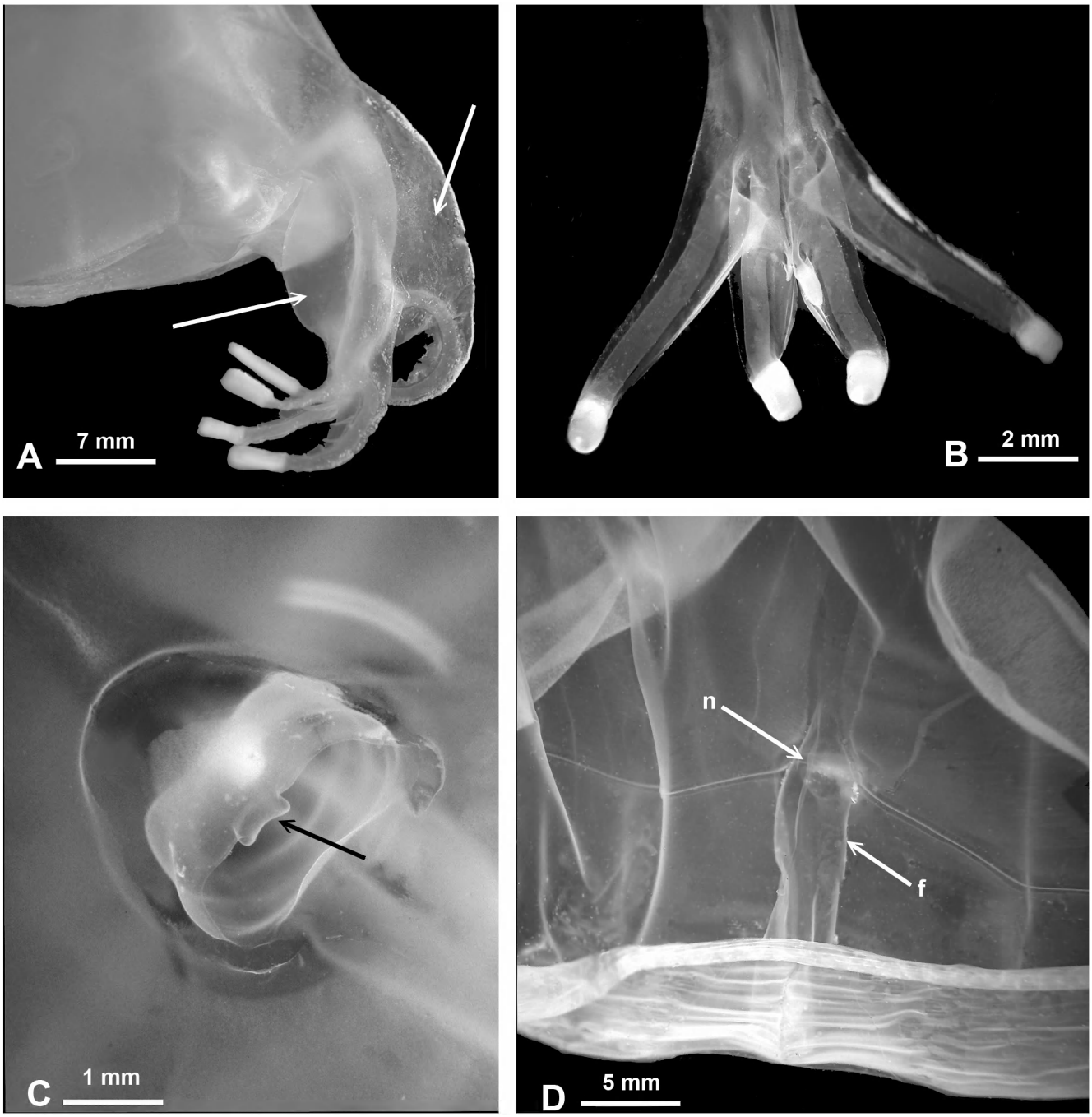

Fig. 2. *Chiropsalmus bart* n. sp. **A**, pedalium, side view; note abaxial and adaxial keels (arrows); **B**, pedalium, adaxial view; **C**, rhopaliar niche ostium, exumbrellar view; note flap (arrow); **D**, rhopaliar niche (n), subumbrellar view, and thickened gelatinous frenulum (f).

not be definitively determined due to loss of tentacles on all specimens.

Rhopalial niche substantially raised from exumbrellar surface. Ostium dome-shaped, with well-developed upper covering scale and no lower scale; upper scale with horizontal, cigar-shaped or banana-shaped flap hanging down in middle to shield rhopalium (Fig. 2C). Niche with single low rounded extension in each of the two upper corners, giving niche a tall, rectangular appearance. Rhopalium with 6 eyes, 2 median ones with lenses; and 2 pairs of lateral eye spots. Statolith located below main eye, rather than behind it; statolith shape could not be determined due to loss in preserved material. Rhopalial window flat on subumbrellar wall, overgrown by top of frenulum (Fig. 2D).

Velarial canals originating from two main canal roots in each octant, but branching so profusely as to be impossible to count. Perradial lappets not substantially raised, but very broad, with many canals emanating from lateral and distal edges (Fig. 3A). Frenulum a solid, gelatinous structure, extending about 3/4 distance toward velarial margin (Fig. 2D).

Gastric saccules forming a coalesced, kidney-bean-shaped structure (Fig. 3B), solid and knob-like, projecting into subumbrellar cavity but not pendant. Gonads leaf-like, attached along entire bell height of interradii, wider

Table 1. Comparison of characters of species in the family Chiropsalmidae.

	Gastric saccules	Pedalial branching	Pedalial canal	Tentacle no; cross section	Bell texture	Distribution
Chiropsalmus quadrumanus (Müller)	Simple, solid, half as long as the bell	In both directions; all along pedalium	Undivided, branching in both directions; without thorn	Up to 7–9; round and fine	With nematocyst warts	Type from southern Brazil; reported to South Carolina USA
Chiropsalmus zygonema Haeckel	Oval, very small	Two asymmetrical tentacles	(Unknown)	2; Unknown shape	(Unknown)	Argentina; found only once
Chiropsalmus alipes Gershwin	Simple, small, with one edge wavy	In both directions; terminal	Divided; with 90° corner at bend	Up to 3–4; round and thick	With nematocyst warts	W. coast of southern Mexico
Chiropsella bronzie Gershwin	Simple, solid, sessile, separate	In both directions; all along pedalium	Divided, each branching in only 1 direction; with 'knee'-like bend	Up to 9; round and fine	Smooth, lacking nematocysts	N. QLD from Cooktown to Townsville
Chiropsella bart n. sp.	Simple, solid, sessile, coalesced	In both directions; nearly terminal	Divided, each branching in only 1 direction; with 'volcano' at bend	Up to 5–6; round and fine	Smooth, lacking nematocysts	Gove Peninsula, Arnhem Land, NT
Chiropsoides buitendijki (Horst)	Simple, hollow, as long as the bell, separate	In one direction only; all along pedalium	Undivided, branching in only 1 direction; with 'thorn' at bend	Up to 5–6; flat and ribbon-like	Smooth, lacking nematocysts	Type from Java Sea; reported from Sri Lanka and southern India
Chiropsoides quadrigatus (Haeckel)	Too young for determination	In one direction only; all along pedalium	Undivided, branching in only 1 direction; with 'thorn' at bend	4; flat and ribbon-like	Smooth, lacking nematocysts	Type from Rangoon; all other records doubtful

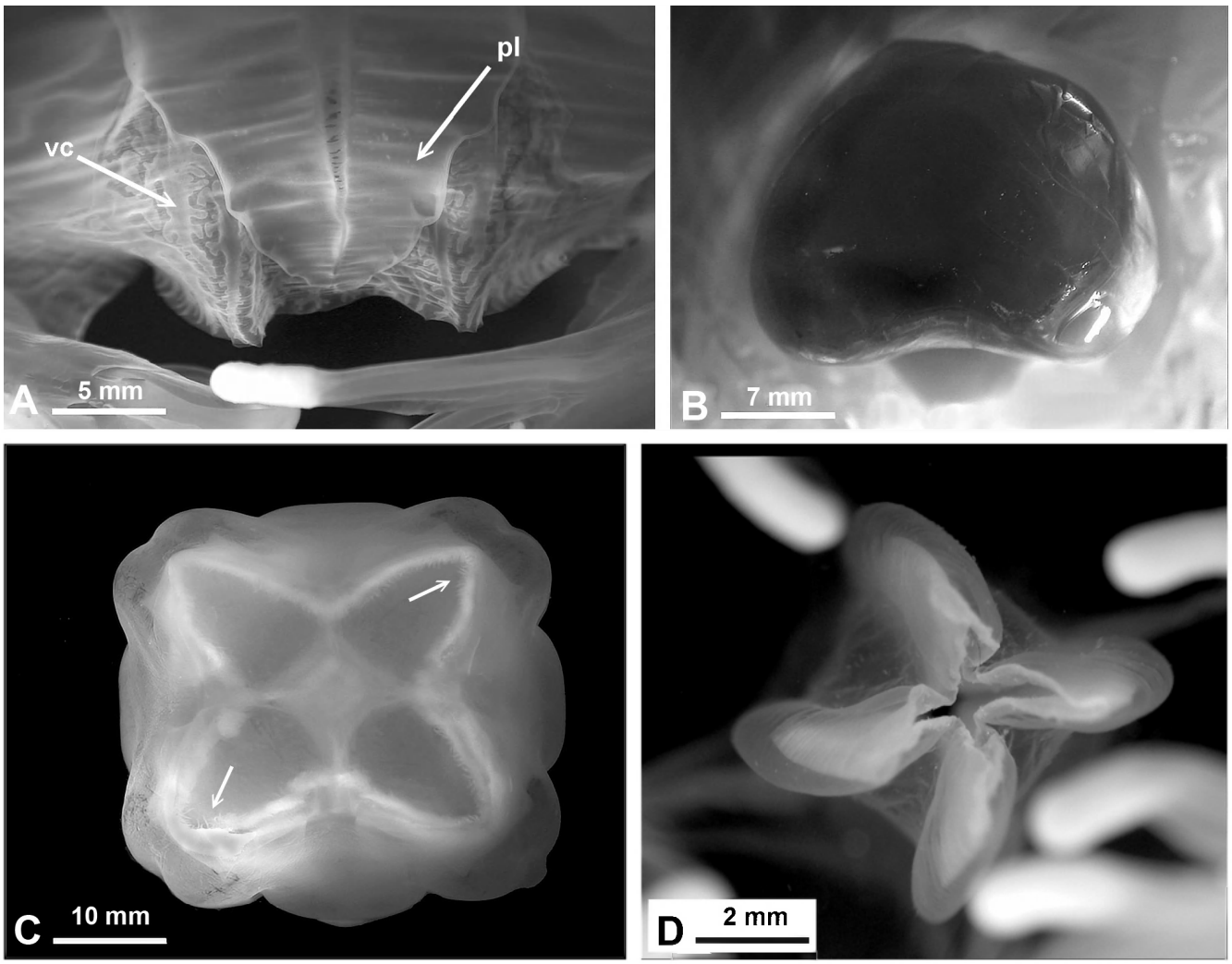

Fig. 3. *Chiropsalmus bart* n. sp. **A**, perradial lappets (pl) and velarial canals (vc) from one quadrant of velarium, exumbrellar view; **B**, gastric saccules, one coalesced pair; **C**, gastric phacellae (arrows), apical view; **D**, mouth, subumbrellar view.

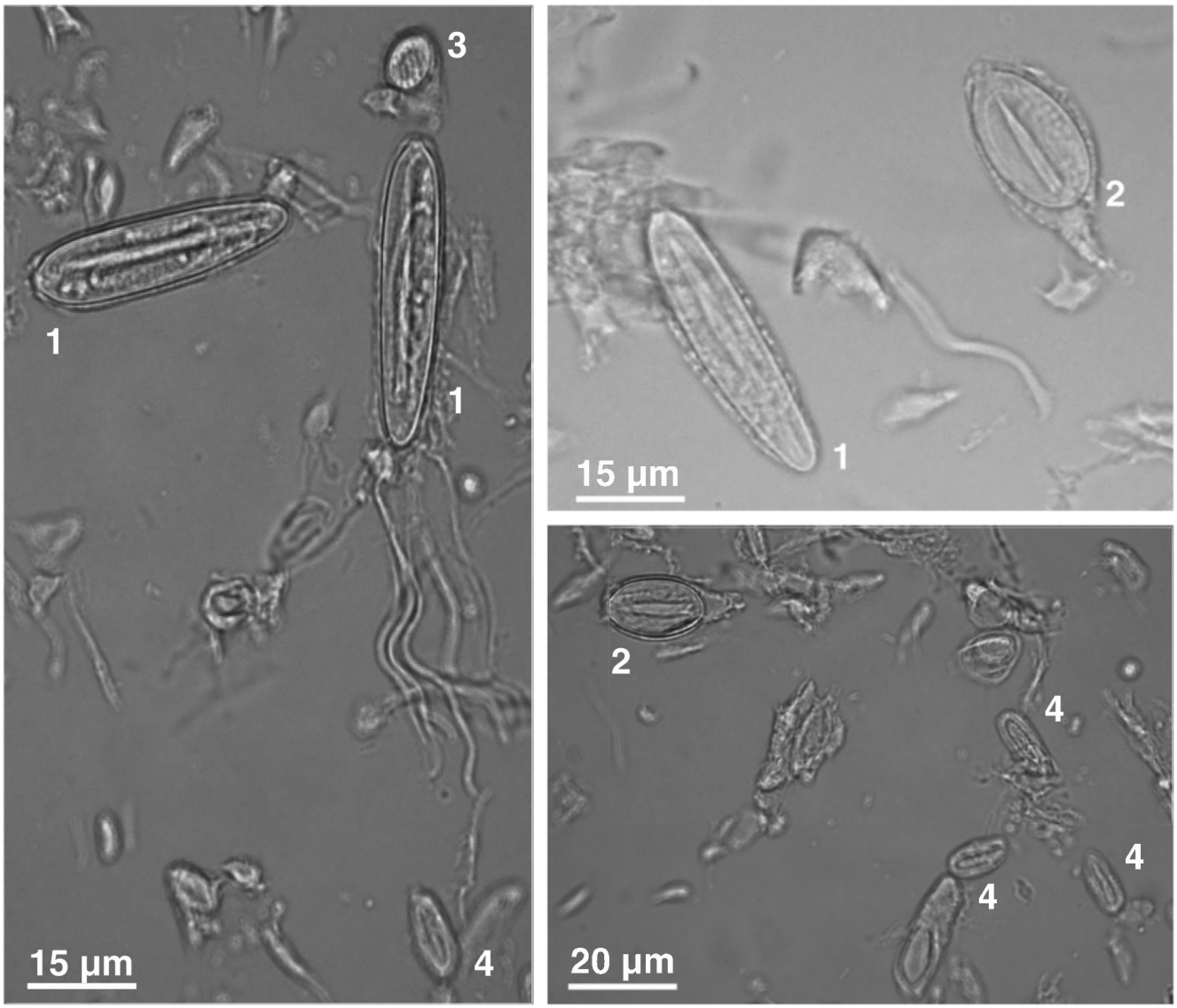

Fig. 4. *Chiropsalmus bart* n. sp. cnidome. Cigar-shaped microbasic *p*-mastigophores (1): large football-shaped microbasic *p*-mastigophores (2): small oval 'beehive' isorhizas (3): small rod-shaped isorhizas (4).

in middle than at top or bottom (Fig. 1). Interradial septa not observed. Stomach shallow and flat, with very short mesenteries reaching only about as far as edge of phacellae. Phacellae continuous, shaped like 4-pointed star (Fig. 3C). Mouth cruciform, with short, smooth lips (Fig. 3D), hanging to about 1/3 bell height.

Cnidome (Fig. 4). Four types of nematocysts found in squash preparation from tentacle of holotype: 1) Cigar-shaped microbasic *p*-mastigophores, 39.28–44.84 µm x 8.79–10.92 µm, n=12; 2) Large football-shaped *p*-rhopaloids, 21.27–26.29 µm x 12.73–14.37 µm, n=10; 3) Small oval 'beehive' isorhizas, 9.04–9.94 µm x 6.88–7.71 µm, n=5; 4) Small rod-shaped isorhizas, 13.21–14.20 µm x 6.54–7.27 µm, n=3.

Etymology. Named to honour Prof. Bart Currie, of the Menzies School of Health Research, Darwin, Northern Territory. Bart's meticulous studies and observations have led to many important contributions in the medical aspects of cubozoology, and he kindly brought this species to our attention. Noun in apposition.

Systematic remarks. *Chiropsella bart* is characterised by a curious morphology. Like *Chiropsella bronzie* Gershwin, from North Queensland – previously erroneously called *C. quadrigatus*, e.g., Barnes (1965, 1966); Cleland and Southcott (1965); Keen (1971); Freeman and Turner (1972); Brown (1973); Fenner (1986) – the gastric saccules are sessile, solid gelatinous knobs. However, in *C. bart* the saccules are coalesced, whereas in *C. bronzie* they are divided. No other chirodropid possess sessile, solid saccules such as these. The tentacles are also round in cross section and very fine in both species, although the pedalia are quite different, being long and scalpel-shaped in *C. bart* but more claw-like in *C. bronzie*. Finally, in fully mature *C. bart*, the tentacles are typically five per pedalium, with one specimen sprouting a sixth on one pedalium; in contrast, fully mature *C. bronzie* have up to about nine tentacles.

DISCUSSION

Chiropsella bart is a most remarkable medusa, being primarily present during the Northern Territory dry season (Currie *et al.* 2002), contrasting with all other known tropical species of cubozoans which reach their peak abundances during their local wet season. Very little is currently known about this species, except that it is common in the early dry season on the sandy beaches of Nhulunbuy, where it sometimes swarms in the hundreds or thousands (unpublished GPSLSC netting records).

The sting of *Chiropsella bart* produces only mild pain and itching, usually persisting less than two hours (Currie *et al.* 2002). It is perhaps the mildest sting known in the Chirodropida.

Chiropsella bart is one of the numerous new species of Australian Chirodropida, a group where the species richness has not been previously appreciated. Others include a small chiropsalmid from northern New South Wales, which is the first known member of the Chirodropida from temperate waters; new species of *Chironex* from each of the Gulf of Carpentaria, the Darwin region, and the Broome region; and a very unusual new species with black tentacles, found in the far northern Kimberley region. In addition to the recently described *Chiropsella bronzie* from North Queensland (Gershwin 2006a), the most peculiar *Chirodectes maculatus* with a spotted exumbrella, subumbrellar muscle bands, filamentous gonads, and no gastric saccules, was recently described by Cornelius *et al.* (2005). For most of these species, their formal description will be only the tip of the iceberg, so to speak, with the remaining features of their biology, ecology, and toxinology yet to be elucidated.

ACKNOWLEDGMENTS

We are indebted to Bernie Whelan, the volunteers of the Gove Peninsula Surf Life Saving Club, and the staff of the Gove District Hospital for collecting the specimens used in the type series and information to help us understand the species. We thank Bart Currie and Susan Jacups for providing us with specimens, collection records, and nematocyst information. LG gratefully acknowledges funding from Australian Biological Resources Study (ABRS grant No. 20045 to LG and W. Zeidler), Great Barrier Reef Research Foundation, CRC Reef, James Cook University, Fulbright Foundation, Lions Foundation, Robert W. King Memorial Scholarship, Surf Life Saving, and a Merit Research Grant (to M. Kingsford).

REFERENCES

Agassiz, L. 1862. *Contributions to the natural history of the United States of America. vol. IV. pt. III. Discophorae. pt. IV. Hydroidae. pt. V. Homologies of the Radiata*. Little, Brown; Trubner: Boston, London.

Barnes, J.H. 1965. *Chironex fleckeri* & *Chiropsalmus quadrigatus* – morphological distinctions. *North Queensland Naturalist* **32**(137): 13–22.

Barnes, J.H. 1966. Studies on three venomous Cubomedusae. Pp 307–332. In: Rees, W.J. (ed.) *The Cnidaria and their evolution*. Academic Press: London.

Brown, T.W. 1973. *Chironex fleckeri – distribution and movements around Magnetic Island, North Queensland*. World Life Research Institute: Colton, California.

Calder, D.R. 1974. Nematocysts of the coronate scyphomedusa, *Linuche unguiculata*, with a brief reexamination of scyphozoan nematocyst classification. *Chesapeake Science* **15**: 170–173.

Carrette, T., Alderslade, P. and Seymour, J. 2002. Nematocyst ratio and prey in two Australian cubomedusans, *Chironex fleckeri* and *Chiropsalmus* sp. *Toxicon* **40**(11): 1547–1551.

Cleland, J.B. and Southcott, R.V. 1965. *Injuries to man from marine invertebrates in the Australian Region*. Commonwealth of Australia: Canberra.

Cornelius, P.F.S., Fenner, P.J. and Hore, R. 2005. *Chiropsalmus maculatus* sp. nov., a Cubomedusa from the Great Barrier Reef. *Memoirs of the Queensland Museum* **51**(2): 399–405.

Currie (1992) {Author add}

Currie, B.J. and Jacups, S.P. 2005. Prospective study of *Chironex fleckeri* and other box jellyfish stings in the "Top End" of Australia's Northern Territory. *Medical Journal of Australia* **183**(11/12): 631–636.

Currie, B., McKinnon, M., Whelan, B. and Alderslade, P. 2002. The Gove chirodropid: a box jellyfish appearing in the 'safe season' [letter]. *Medical Journal of Australia* **177**(11/12): 649.

Edmonds, C. 1975. *Dangerous marine animals of the Indo-Pacific Region*. Wedneil Publications: Newport, Victoria, Australia.

Fenner, P. 1986. The management of stings by jellyfish, other than *Chironex*. *South Pacific Underwater Medicine Society Journal* **16**: 97–100.

Freeman, S.E. and Turner, R.J. 1972. Cardiovascular effects of cnidarian toxins: a comparison of toxins extracted from *Chiropsalmus quadrigatus* and *Chironex fleckeri*. *Toxicon* **10**(1): 31–37.

Gershwin, L. 2005. *Taxonomy and phylogeny of Australian Cubozoa*. Unpublished PhD thesis. School of Marine Biology and Aquaculture. James Cook University: Townsville, Queensland.

Gershwin, L. 2006a. Comments on *Chiropsalmus* (Cnidaria: Cubozoa: Chirodropida): a preliminary revision of the Chiropsalmidae, with descriptions of two new species. *Zootaxa* **1231**: 1–42.

Gershwin, L. 2006b. Nematocysts of the Cubozoa. *Zootaxa* **1232**: 1–57.

Gordon, M., Hatcher, C. and Seymour, J. 2004. Growth and age determination of the tropical Australian cubozoan *Chiropsalmus* sp. *Hydrobiologia* **530/531**: 339–345.

Horst, R. 1907. On a new cubomedusa from the Java-Sea: *Chiropsalmus buitendijki*. *Notes from the Leyden Museum* **29**(2): 101–106.

Keen, T.E.B. 1971. Comparison of tentacle extracts from *Chiropsalmus quadrigatus* and *Chironex fleckeri*. *Toxicon* **9**(3): 249–254.

Mariscal, R.N. 1971. Effect of a disulfide reducing agent on the nematocyst capsules from some coelenterates, with an illustrated key to nematocyst classification. Pp 157–168. In: Lenhoff, H.M., Muscatine, L. and Davis, L.V. (eds) *Experimental coelenterate biology*. University of Hawaii Press: Honolulu.

Sutherland, S.K. 2001. *Australian animal toxins, second edn*. Oxford University Press: South Melbourne.

Thiel, M.E. 1936. Scyphomedusae: Cubomedusae. *H.G. Bronns Klassen und Ordnungen des Tierreichs* **2**(2): 173–308.

Werner, B. 1973. New investigations on systematics and evolution of the class Scyphozoa and the phylum Cnidaria. *Publications of the Seto Marine Biological Laboratory* **20** (Proceedings of the Second International Symposium on Cnidaria): 35–61.

Werner, B. 1984. Klasse Cubozoa. Pp 106–133. In: Gruner, H.E. (ed.), *Lehrbuch der Speziellen Zoologie*. Gustav Fischer Verlag: Stuttgart.

Williamson, J., Fenner, P., Burnett, J. and Rifkin, J. 1996. *Venomous and poisonous marine animals: a medical and biological handbook*. NSW University Press: Sydney, Australia.

Accepted 17 October 2006