

A complete list of plants collected by Preiss from Mt Eliza and cited in *Plantae Preissianae*, volumes 1 and 2 (Lehmann 1844-8) is given below (Table 1).

Table 1: Preiss collections from Elizamountain, Mt Eliza or Elizamountagne.

Preiss Number	Date	Name Given in <i>Plantae Preissianae</i>	Volume and Page Number
1874	19 Jan 1839	<i>Typha shuttleworthii</i> Sond et Koch	2:3
2306	20 Jan 1839	<i>Hemiandra brevifolia</i> Benth.	1:355
2358	21 Jan 1839	<i>Patersonia turfosa</i> Endl.	2:31
2317	27 Jan 1839	<i>Hemiandra hirsuta</i> Benth.	1:355
1083	18 May 1839	<i>Templetonia retusa</i> R.Br.	1:88
93	19 May 1839	<i>Eurybia axillaris</i> DC. v <i>exaltata</i> Steetz	1:418
1689	19 May 1839	<i>Pomaderris albicans</i> Steud.	1:184
1689	19 May 1839	<i>Trymalium albicans</i> Reiss	2:280
1770	June 1839	<i>Elynanthus octandrus</i> Neers ab Esenb.	2:77
2663	June 1839	<i>Agaricus australis</i> Fries	2:131
2150	17 June 1839	<i>Candollea parviflora</i> Steud.	1:276
1985	20 Aug 1839	<i>Drosera porrecta</i> Lehm.	1:252
1735	Sept 1839	<i>Baumea preissii</i> Nees ab Esend.	2:75
638	23 Sept 1839	<i>Petrophile macrostachya</i> R.Br.	1:502
1478	23 Sept 1839	<i>Scaevola holosericea</i> de Vriese	1:408
1570	23 Sept 1839	<i>Thysanotus tenuis</i> Lindl.	2:37
2017	23 Sept 1839	<i>Ricinocarpus glaucus</i> Endl.	2:229
2230	23 Sept 1839	<i>Libertia laxa</i> Endl.	2:32
1216	25 Sept 1839	<i>Cryptandra tridentata</i> Steud v <i>tomentosa</i> Reiss	2:289
1564	2 Oct 1839	<i>Thysanotus anceps</i> Lindl.	2:37
1571	25 Oct 1839	<i>Thysanotus triandrus</i> R.Br.	2:38
1517	25 Oct 1839	<i>Scaevola multiflora</i> Lindl.	1:407
44	25 Oct 1839	<i>Pachysorus angianthoides</i> Steetz	1:442

Note number 1689, collected 19 May 1839 was described in Volume 1 as *Pomaderris albicans* and in Volume 2 as *Trymalium albicans*.

SYNONYMY OF NON-TYPE COLLECTIONS

Hemiandra brevifolia and *Hemiandra hirsuta* are both currently called *Hemiandra pungens*.

Typha shuttleworthii currently is called *Typha domingensis*.

Scaevola multiflora is currently called *Scaevola nitida*.

Thysanotus tenuis and *Thysanotus anceps* were incorrectly named by Preiss and are *Thysanotus thyrsoides* and *Thysanotus arenarius* respectively.

CURRENTLY ACCEPTED NAMES

The following species names listed by Preiss are still current today.

Templetonia retusa
Petrophile macrostegia
Ricinocarpus glaucus
Thysanotus triandrus

COMMENTS

Baumea preissii of *Typha shuttleworthii* do not grow in present-day Kings Park. Both are plants which grow in seasonally waterlogged soil bordering lakes and water-courses. With development of Mounts Bay Road this habitat was lost.

Calocephalus angianthoides has not been recorded in recent years from Kings Park so this presumably is a species which has become locally extinct with the development of Perth. It is of interest that Kings Park is a type locality for a number of species still extant so near the centre of a large city, and today can afford researchers the opportunity to revisit the type locality and to know that even though in the centre of a city the plants are safe.

ACKNOWLEDGEMENTS

I wish to thank Dr Neville Marchant from the Western Australian Herbarium who assisted and encouraged me with the preparation of this paper.

REFERENCES

- BRITTAN, N.H. 1987. *Thysanotus*. In: *Flora of Australia* 45: 308-338.
 HILTON, R.N. 1988. The Preiss collection of Western Australian Fungi. *Nuytsia* 6: 295-304.
 LEHMANN, J.G.C. (ed) 1844-1848. *Plantae Preissianae*, Hamburg.
 MARCHANT, N.G. 1990. The Western Australian collecting localities of J.A.L. Preiss. pps 131-135. In: SHORT, P. (ed) *History of Systematic Botany in Australia*. Aust. Systematic Botany Soc. (inc). Brown, Prior, Anderson: Burwood.
 MCGILLIVRARY, D.J. 1975. Johann August Ludwig Preiss (1811-1883) in Western Australia. *Telopea* 1: 1-18.
 SHAW, A.G.L. and CLARK, C.M.H. 1967. *Australian Dictionary of Biography* Vol 2, Melbourne University Press.

THE COMBAT RITUAL OF TWO MONITOR LIZARDS, *VARANUS CAUDOLINEATUS* AND *VARANUS GOULDII*

By GRAHAM G. THOMPSON, PHILIP C. WITHERS,
 Zoology Department University of Western Australia, Nedlands, W.A. 6009
 and SCOTT A. THOMPSON, 22 Bentley Close, Mt Claremont, W.A. 6010.

INTRODUCTION

Ritual male combat has been reported for a number of monitor species, but this is the first report of male ritual combat for either *Varanus caudolineatus* or *V. gouldii*.

Varanus caudolineatus is a small arboreal goanna living in the central coastal and interior areas of central Western Australia, whereas *Varanus gouldii* is found throughout most parts of mainland Australia with the exception of the extreme south-eastern part of the continent (Cogger 1986).

Varanus caudolineatus

At approximately 2.45 pm on 12 December 1990, two adult *V. caudolineatus* (20.1 and 21.8 g) were observed fighting for about 5 minutes, approximately 2 km East of Zado Bore (119° 07'E, 28°S; 55 km SW of Sandstone). The ambient temperature was 36°C and the *V. caudolineatus* were in an area with a partial ground cover of spinifex (*Triodia* sp.) and leaf litter over the red, gritty sand. Approximately 25% of all standing trees were dead and a proportion of

the live trees had dead sections or hollows in their trunks, providing refuge for these arboreal monitors.

One lizard was first seen at the base of a dead tree. The second approached it from a position higher up the tree trunk. The approaching lizard chased the other for a distance of approximately 30 m over and around clumps of spinifex. At the base of a large, dead tree the two animals embraced each other with their fore and hind legs in a ventrally adressed position. They wrestled on the ground with longitudinal rolls, lateral twisting and mutual flexing of the trunk (Figure 1). The bodies of the two adversaries formed an arch from their snout to their tail, while wrestling. Each animal bit the other on the flank, limbs and tail. One *V. caudolineatus* broke free and quickly ran up the dead tree, pursued by the other. Both animals stopped about 40 cm above the ground in a head to tail position, separated by approximately 5 cm. Rapid, gular panting was evident in both lizards for a short peirod of time until the lower lizard moved toward the other animal. Both then returned to the ground to embrace with fore and hind limbs and continue their fighting behaviour. Fierce biting by both lizards was apparent but a subsequent inspection of the animals revealed no obvious damage to either lizard. It appeared that each lizard was attempting to throw its opponent onto its back. The two dorso-ventrally flattened, embraced lizards rolled longitudinally, and continued to arch their backs, for approximately two minutes at the base of the dead tree. Both animals appeared to be continually attempting to change their hold by repositioning their limbs, and to bite the other on the flank or tail, if the opportunity arose during the struggle. Finally, both lizards ceased their fighting behaviour and remained at the base of the tree, with rapid gular panting. They were captured by hand about 30 seconds later.

V. caudolineatus are normally very wary and will very quickly move to a position on the other side of a tree, or into a hollow, to avoid detection. However, neither animal appeared to be concerned, during this combat behaviour, that they were being watched closely and photographed by three observers.

Varanus gouldii

At approximately 10.00 am on 18 December 1990, approximately 150 km SW of Sandstone, we observed two *V. gouldii* in a bipedal posture (Figure 2). They were embracing each other with fore limbs, so that their ventral surfaces were touching. Because the behaviour was characteristic of the male varanid combat ritual, we presumed that they were both males. As we drew closer the two animals fell to the ground, embracing each other with both fore and hind limbs, while writhing and rolling on the graded road. After a couple of minutes they became aware of our presence and separated. Upon us moving closer, both animals quickly fled into the same burrow on the road side verge. Fresh marks in a rectangular area (2.5 x 1.5 m) on the dirt road indicated that the struggle had continued for some time before we had come upon these males in their combat ritual. It appeared as if these two lizards had longitudinally rolled on the ground for part of this time. There were no apparent signs that either lizard had inflicted any damage to the other.



Figure 1: *Varanus caudolineatus* in combat embrace. Drawn from photo taken 12 December 1990.

PHYLOGENIC RELATIONSHIP OF MALE COMBAT RITUAL IN VARANIDS

The combat behaviour of *V. gilleni* is very similar to that of *V. caudolineatus* which is not surprising given that *V. caudolineatus* is "morphologically and ecologically fairly similar" to *Varanus gilleni* (Pianka 1969) and most probably in the Odatria group (D. King pers. comm.). Murphy and Mitchell (1974) and Carpenter *et al.* (1976) record the ritualized combat behaviour of male pygmy mulga monitors (*V. gilleni*), from the Dallas Zoo, which occurred in the presence of a female of the same species. Deraniyagala (1958 in Murphy and Mitchell 1974), Waite (1929, species corrected in Horn 1981), Honegger and Heusser (1969 in Murphy and Mitchell 1974) and Auffenberg (1981 and 1988) reported male ritualistic behaviour for *V. bengalensis*, *V. spenceri*, *V. salvator*, *V. bengalensis* and *V. olivaceus* respectively. Greer (1989) provides photographic evidence of two *V. mertensi* in a bipedal combat embrace. Twigg (1988) and Horn (1980) describe the bipedal combat embrace of *V. varius* with accompanying photographs to illustrate their behaviour. Horn (1985) reviewed male combat behaviour in *V. komodoensis*, *V. semiremex*, *V. timorensis timorensis* and *V. scalaris* (reported by Horn 1985 as *V. t. similis* but now recognized by Storr *et al.* 1983 as *V. scalaris*).

The two different behaviour patterns of male ritual combat described by Horn (1985) for various varanids seem consistent within the two lineages of Varanidae in Australia described in King *et al.* (in press), namely the 'gouldii group' and the 'Odatria group'. The data presented here for male ritual combat in *V. gouldii* (*gouldii* group) and *V. caudolineatus* (Odatria group) provides further supporting evidence for the male combat ritual behaviour differences described by Horn (1985) being consistent with lineage. The *gouldii* group (*V. spenceri*, *V. mertensi*, *V. varius*, *V. komodoensis* and *V. gouldii*) grasp each other

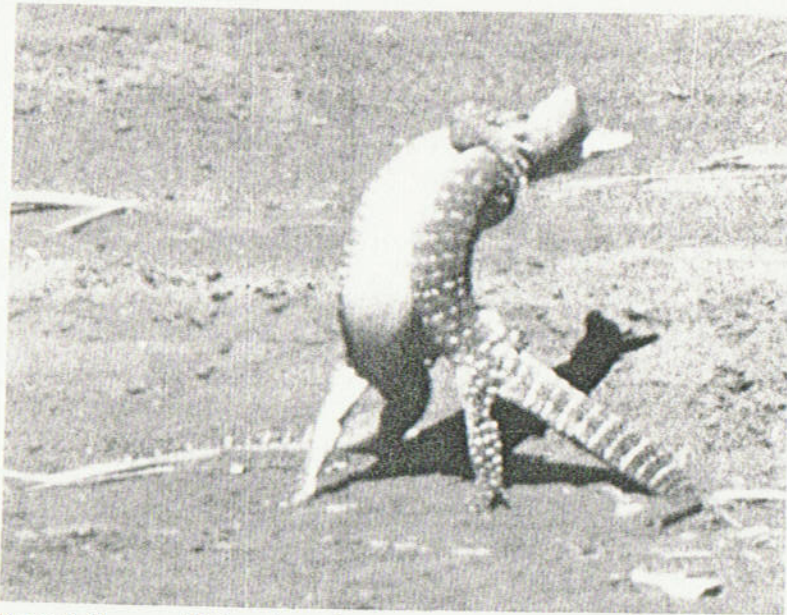


Figure 2: *Varanus gouldii* in combat embrace. Photo taken 18 December 1990.

with fore limbs and rise in a bipedal embrace. When males fall laterally from their bipedal embrace they may roll longitudinally on the ground for some time (e.g. *V. varius*, Twigg 1988) before abandoning the fight or again moving into an upright posture. In comparison, the Odatria group (*V. gilleni*, *V. semiremex*, *V. timorensis*, *V. scalaris* and *V. caudolineatus*) grasp each other with fore and hind limbs with their ventral aspects in contact. They do not have a bipedal embrace. They often form a bridge by flexing their backs in concert, similar to that described by Murphy and Mitchell (1974) for *V. gilleni*.

This is the first record of combat behaviour for *V. caudolineatus* and *V. gouldii*, although it is apparent that such behaviour is common to this genus. The behavioural differences observed between *V. gouldii* and *V. caudolineatus* are consistent with those of Horn's (1985) descriptions for varanids that can be different Australia lineages of *Varanus* (King, in press).

ACKNOWLEDGEMENTS

This manuscript benefited greatly from the comments of Dennis King and L. Twigg. The drawing by Joanne Lauri of the combat ritual of *V. caudolineatus* from a photograph is acknowledged and was very much appreciated.

REFERENCES

- AUFFENBERG, W. 1981. Combat behaviour in *Varanus bengalensis* (Sauria: Varanidae). *J. Bombay Nat. Hist. Soc.*, 7(1): 54-72.
- AUFFENBERG, W. 1988. *Gray's Monitor Lizard*. Uni. Presses of Florida, Gainesville.
- CARPENTER, C.C., GILLINGHAM, J.C., MURPHY, J.B. and MITCHELL, L.A. 1976. A Further Analysis of the Combat Ritual of the Pygmy Mulga

- Monitor, (*Varanus gilleni* (Reptilia: Varanidae), *Herpetologica*, 32(1): 35-40.
- COGGER, H.G. 1986. *Reptiles and Amphibians of Australia*. Reed, N.S.W.
- GREER, A.E. 1989. *The Biology and Evolution of Australian Lizards*. Surrey Beatty & Sons, N.S.W.
- HORN, H-G. 1980. Bisher unbekannte Details zur Kenntnis von *Varanus varius* auf Grund von feldherpetologischen und terraristischen Beobachtungen (Reptilia: Sauria: Varanidae). *Salamandra*, 16: 1-18.
- HORN, H-G. 1985. Beiträge zum Verhalten von Waranen: Die Ritualkämpfe von *Varanus komodoensis* Ouwens, 1912 und *V. semiremex* Peters, 1969 sowie die Imponierphasen der Ritualkämpfe von *V. timorensis timorensis* (Gray 1831) and *V. t. similis* Mertens, 1958 (Sauria: Varanidae). *Salamandra*, 21(2/3): 169-179.
- HORN, H-G. 1981. *Varanus spenceri*, nicht *Varanus giganteus*: eine Richtigstellung (reptilia: Sauria: Varanidae), *Salamandra*. 17(1/2): 78-81.
- MURPHY, J.B. and MITCHELL, L.A. 1974. Ritualized Combat Behaviour of the Pygmy Mulga Monitor Lizard, *Varanus gilleni* (Sauria: Varanidae). *Herpetologica* 30(1): 90-97.
- KING, D., KING, M. and BAVERSTOCK, P. in press. A new phylogeny of the Varanidae, Mertensiella.
- PIANKA, E.R. 1969. Notes on the Biology of *Varanus caudolineatus* and *Varanus gilleni*. *West. Aust. Nat.* 11: 76-82.
- STORR, G.M., SMITH, L.A. and JOHNSTONE, R.E. 1983. *Lizards of Western Australia II, Dragons and Monitors*, W.A. Museum, Perth.
- TWIGG, L.E. 1988. A Note on Agonistic Behaviour in Lace Monitors, *Varanus varius*. *Herpetofauna* 18(1): 23-25.
- WAITE, E.R. 1929. *The reptiles and amphibians of South Australia*. Government Printer, Adelaide.

PROBABLE SPAWNING SITE OF THE FRESHWATER COBBLER TANDANUS BOSTOCKI LOCATED IN THE MURRAY RIVER WESTERN AUSTRALIA

By MICHAEL JOHN HUTCHISON, Geography Department
University of Western Australia, Nedlands 6009.
Present address: Nikko Branch, National Research Institute of
Aquaculture, 2482-3 Chugushi, Nikko, Tochigi 321-16, Japan.

INTRODUCTION

The freshwater cobbler *Tandanus bostocki* is the largest indigenous inland species in south-western Australia, attaining a total length of at least 55 cm and a weight of at least 2.27 kg (Coy 1979). Morrison (1988 unpublished Ph D. thesis) studied the breeding biology of this species in Wungong Dam. Through use of gonadal-somatic indices, he was able to determine that spawning took place between November and January, but he did not observe the prespawning or spawning behaviour of this species or locate any spawning sites.

The related eastern Australian *T. tandanus* are known to spawn at water temperatures greater than 24°C, and temperature, rather than flooding