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Mashonarus guttatus, gen. and sp. n., the second termitivorous jumping spider from Africa (Araneae: Salticidae)

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Summary

A new jumping spider from Africa, preying on the termite *Odontotermes transvaalensis* (Sjöstedt), is described, along with data on its life cycle and behaviour. A comparison is made with another termitivorous salticid, *Microheros termitophagus* Wesołowska & Cumming, which feeds on the same species of termite in Zimbabwe.

Introduction

Termite-hunting spiders are not uncommon (e.g. Dean, 1988; Jocqué & Dippenaar-Schoeman, 1992; Dippenaar-Schoeman *et al.*, 1996), yet the first description of a salticid specialised in catching such prey, from Zimbabwe and South Africa, was made only recently (Wesołowska & Cumming, 1999). Here we describe another termitivorous salticid species, *Mashonarus guttatus*, gen. and sp. n., preying on *Odontotermes transvaalensis* (Sjöstedt) in southern Africa. We present data on its habitat, life cycle and behaviour, and compare them with those of the previously described termitophagous salticid, *Microheros termitophagus* Wesołowska & Cumming, 1999.

Material and methods

The material that forms the basis of this paper is deposited in the following collections: MRAC = Musée Royal de l'Afrique Centrale, Tervuren; SMN = State Museum of Namibia, Windhoek; CAS = California Academy of Sciences, San Francisco; NMZ = National Museum (Natural History) of Zimbabwe, Bulawayo; PPRI = Plant Protection Research Institute, Pretoria; MNH = Museum of Natural History, Wrocław University, Wrocław.

Abbreviations used in the text: ap = apical, d = dorsal, Fm = femur, Mt = metatarsus, pl = prolateral, Pt = patella, rl = retrolateral, Tb = tibia, v = ventral. Chaetotaxy is in accordance with the system adopted by Ono (1988). Measurements are given in millimetres. The sequence of leg segments in the measurement data is: femur + patella + tibia + metatarsus + tarsus.

Field observations: *Mashonarus guttatus* was recorded between 1992 and 1994, as part of a study on the relationship between the termite *O. transvaalensis* and the invertebrates interacting with them on the open chimneys of their mounds (Cumming, 1993, 1995, 1996). Between 1998 and 2000 the focus changed to a broad study of the 38 species of salticids (including *M. guttatus*) occurring in a 0.6 ha garden in Harare, Zimbabwe (Cumming & Wesołowska, 2000). The two sets of data complement each other. A total of 94 field observations was recorded. For taking measurements, captive living spiders were held in glass vials above graph paper, then returned to the field.

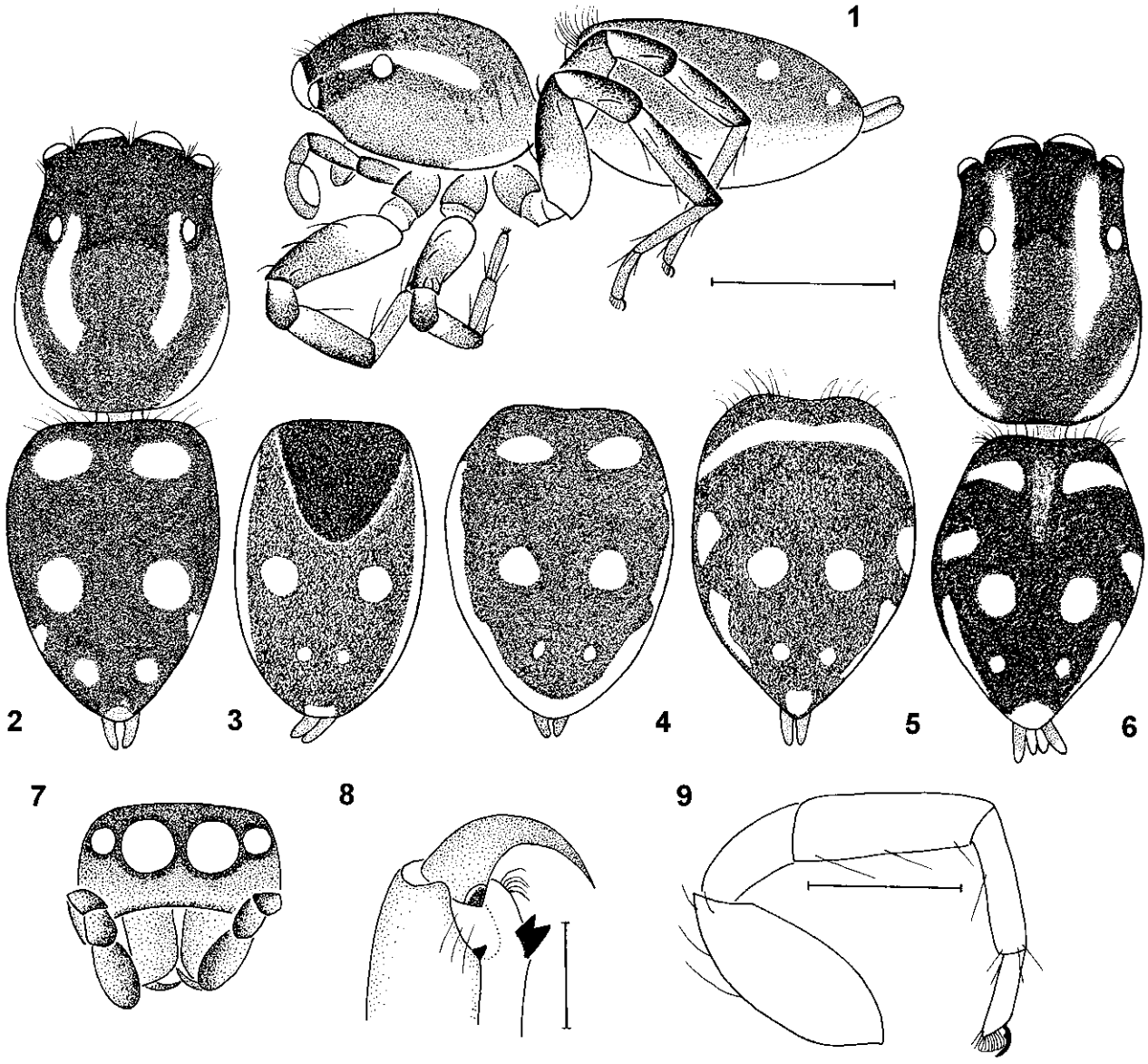
Genus *Mashonarus*, new genus

Type species: *Mashonarus guttatus*, n. sp.

Etymology: The generic name is derived from Mashonaland, a province of Zimbabwe, *terra typica* for the type species of the genus. Gender masculine.

Description: Medium sized spiders, 4.2–7.0 mm in length. Both sexes similar in general body form and coloration. Cephalothorax rather low, a little higher in thoracic region. Carapace broadening posteriorly, widest at three-quarters of its length. Eye field short, rectangular, second row of eyes mid-way between first and third rows. Clypeus low. Chelicerae medium, more or less vertical, with very small retromarginal tooth and bicuspid promarginal tooth. Maxillae more or less parallel. Labium subtriangular. Sternum oval. Pedicel short, almost invisible in dorsal view. Abdomen shield-shaped or oval, in males sometimes with small scutum dorsally. Spinnerets almost equal in length, but anteriors slightly thinner than posteriors. Legs equally developed, leg formula III, IV, I, II.

Diagnosis and affinities: *Mashonarus* can be easily recognised by the structure of the genital organs. The general habitus of both sexes is typical for members of the Aelurillinae — a pear-shaped carapace with short eye field, rich chaetotaxy, long dense hairs on anterior abdominal margin, eye field covered with dense hairs, placement of sperm duct in male palp. The male palp with a single, thin tibial apophysis resembles that of *Langona* Simon, 1901, but differs from it by the absence of scales on the cymbium and of a tuft of bristles next to the apophysis. The embolus in *Mashonarus* is almost completely hidden in a closed cymbial pocket and only its terminal end protrudes beyond the tip of the bulbus; such embolus placement is typical of the majority of Aelurillinae (Logunov, 1996). The embolus itself, visible after removal of the cymbium, is simple, slender and relatively short. Its structure is unique, because the other genera have either a longer, coiled embolus on the bulbus tip (e.g. *Langona*), or a thicker, clearly compound one (e.g. *Phlegra* Simon, 1876). The epigyne is also distinctive. Whereas the receptacles in the majority of Aelurillinae are heavily sclerotised and multi-chambered, *Mashonarus* has a very simple epigynal structure, comparable to that of *Stenaelurillus* Simon, 1885, the genus whose placement into the Aelurillinae remains doubtful. Also the shield-shaped abdomen and coloration pattern of *Mashonarus* resemble those



Figs. 1–9: *Mashonarus guttatus*, n. sp. **1** General appearance of male, lateral view; **2, 3** Coloration pattern of male; **4–6** Coloration pattern of female; **7** Frontal view of male; **8** Cheliceral dentition, posterior view; **9** First leg. Scale lines = 2.0 mm (1–7), 1.0 mm (9), 0.3 mm (8).

in *Stenaelurillus*. The relationships of *Mashonarus* are obscure and require further study.

Included species: Only the type species.

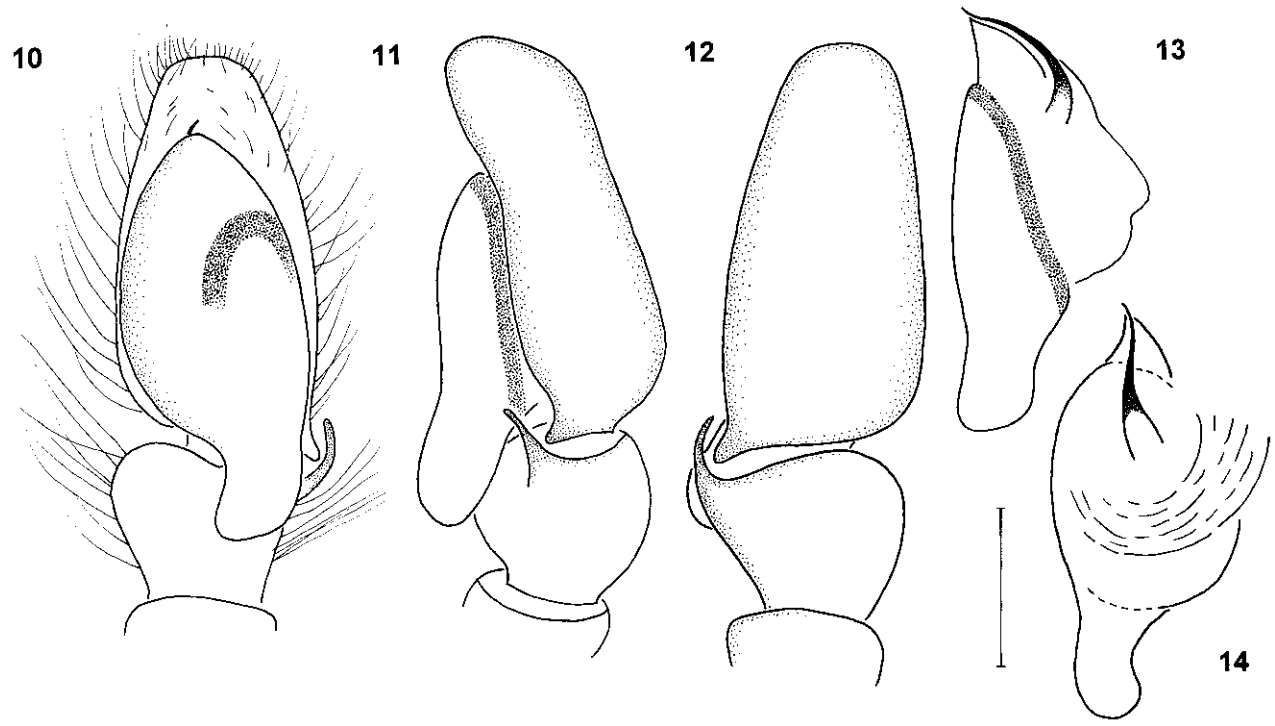
Mashonarus guttatus, new species (Figs. 1–19)

Type material: Holotype ♂, ZIMBABWE: Harare, 17°15′S, 31°02′E, garden, June 1992, leg. M. S. Cumming (MRAC). Paratypes: NAMIBIA: Rundu-Kavango, Okavango, 1♂, May 1979, leg. M. E. Baddeley (MRAC 152 151). ZAMBIA: Chingauka, 15°53′S, 28°11′E, under stones, 1♀, 17 March 1993, leg. E. Marais (SMN 43 049). ZIMBABWE: Victoria Falls, 17°56′S, 25°50′E, 1♀, 1–8 February 1995, leg. W. Puławski (CAS); Siabuwa, 1♀, July 1989, leg. C. Tingle (NMZ/A 8586); Impofu, 1♀, 23 October 1984, leg. D. Adams (NMZ/A 2691); Matusadona, 3♂ 1♀ 1 juv., 29 November 1983, leg. G. Putterill (NMZ/A 2297); Busi river, Chizarira National Park, 1♀, 14 August 1985 (NMZ/A 3525); Redbank at Khami river, 20°00′S, 28°22′E, 1♀, 23 February 1995, leg. W. Puławski (CAS); Kemavanga Camp, 1♀, 16 April 1991, leg. E. Nyathi (NMZ/A 9013); Chipinda Pools, Gonarezhou National Park, 1♀, 20 April 1985, leg. J. Minshull (NMZ/A 3106); 1 km below Makashi Dam Valley, under logs and rocks, 1♀, 29 November 1993 (NMZ/A 10 875); Mana Pools, 2♂ 1♀ 2 juv., 9 May 1984 (NMZ/A 2617); same locality, 1♂, 6 May 1984 (NMZ/A 2571); Matabeleland, Tsholotsho, 1♀, 12 May 1999, leg. L. Sibanda (MNH); same locality, 3♂, 10 September 1998 (early dry hot season), leg. L. Sibanda (MNH); same locality, 1♂ 1♀, September 1999, leg. L. Sibanda (PPRI); Harare (together with holotype), 1♂ 2♀ 1 juv. (MNH); 1♀ (together with holotype) (MRAC).

Etymology: The specific name is Latin for "spotted", and refers to the coloration pattern of this species.

Diagnosis: This species can be distinguished by the coloration pattern and the structure of the copulatory organs. The male palp has the embolus hidden (only tip visible), the bulbus narrow with a large posterior lobe, and a single thin tibial apophysis. The epigyne is very small with indistinct gonopores placed laterally. Its internal structure is simple, consisting of short seminal ducts and single-chambered receptacles.

Description: *Male*: Carapace length 2.3–2.7, width 1.6–2.1, height 1.0. Abdomen length 2.3–2.8, width 1.6–2.1. Eye field length 0.8–1.0, anterior width 1.3–1.5, posterior width 1.3–1.4. Length of leg segments: I 1.2+0.6+0.9+0.6+0.5; II 1.1+0.6+0.7+0.6+0.4; III 1.5+0.8+0.9+1.1+0.6; IV 1.3+0.6+0.9+1.3+0.6. Leg spination: I: Fm d 1-1-4; Tb pl 1-1, v 1-1-1; Mt pl and rl 1ap, v 2-2. II: Fm d 1-1-4; Tb pl 1ap, rl 0-1, v 1-1; Mt d and rl 1ap, pl 1-1ap, v 2-2. III: Fm d 1-1-4; Pt pl and rl 1; Tb pl and rl 1-1ap, v 1-1; Mt d, pl and rl 1-1ap, v 2-2ap. IV: Fm d 1-1-4; Pt pl and rl 1; Tb d and rl 1-1, pl and v 1-2; Mt d, pl and rl 1-1ap, v 2-2ap. General appearance as in Figs. 1 and 2. Carapace medium height, pear-shaped, broadest posteriorly. Eye field short, occupying about one-third of carapace length. Coloration of carapace very dark, dark brown or black, ocular area always black. Two longitudinal, slightly curved white stripes formed by whitish hairs on thoracic dorsum, sometimes extend onto posterior part of eye field. In some specimens, owing to loss of hairs, these stripes absent. Lateral margins of carapace white at bases of legs III and IV. Brown hairs on thorax, dense and long dark setae on ocular area. Clypeus rather low, dark (Fig. 7). Chelicerae dark brown, promargin with bicuspid tooth, single small tooth on retromargin (Fig. 8). Labium and maxillae brown with pale tips. Sternum dark brown. Coxae and trochanters of legs yellowish. Abdomen flattened dorsally, oval or shield-shaped, with straight anterior edge. Abdominal pattern composed of white patches on black background. Black dorsal parts shiny, intensified by prostrate hairs. Three pairs of white rounded patches composed of small scales: anterior pair (near anterior margin) slightly transverse, sometimes merging into transverse streak; median pair (about half of abdomen length) large and circular; posterior pair



Figs. 10–14: *Mashonarus guttatus*, n. sp. **10–12** Palpal organ, ventral, retrolateral and dorsal views; **13–14** Bulbus, retrolateral and dorsal views (cymbium removed). Scale line=0.3 mm.

very small (Fig. 2). Additional small pale patch on end of abdomen, near base of spinnerets. Sometimes (in two specimens) anterior part of abdomen covered by delicate short scutum, then anterior patches not visible (Fig. 3). Venter lighter, yellowish or greyish. Very long and dense dark hairs at anterior edge of abdomen. Spinnerets grey. Legs medium length, III longest; coloration black or brown, only proximal halves of femora lighter; covered with brown hairs, but on bases of segments (especially femora) diminutive white hairs, sometimes forming whitish rings; spines very long, numerous; tarsi with paired claws and claw tuft. Pedipalps rather small, dark brown or blackish. Cymbium narrow, with small retrolateral process at its base (Fig. 12). Bulbus oval, with large posterior lobe. Embolus almost straight, thin (Fig. 14), enveloped by tegulum, only tip of embolus visible in ventral view (Fig. 10). Single tibial apophysis very thin (Figs. 11, 12). Palpal femur without bump.

Female: Carapace length 2.1–2.6, width 1.6–2.0, height 0.8–1.1. Abdomen length 2.3–3.8, width 1.6–2.6. Eye field length 0.8–1.1, anterior width 1.2–1.5, posterior width 1.3–1.5. Length of leg segments: I 1.2+0.7+0.8+0.6+0.5; II 1.2+0.6+0.7+0.6+0.4; III 1.6+0.9+1.0+1.2+0.6; IV 1.4+0.7+1.1+1.4+0.6. Leg spination: I: Fm d 1-1-4; Tb pl and rl 1-1, v 2ap; Mt pl and rl 1ap, v 2-2ap. II: Fm d 1-1-4; Tb pl and rl 1-1, v 2ap; Mt pl and rl 1ap, v 2-2ap. III: Fm d 1-1-4; Pt pl and rl 1; Tb d 1-1, pl 1-1, v 1-2; Mt d, pl and rl 1-1ap, v 2-2ap. IV: Fm d 1-1-4; Pt pl and rl 1; Tb d 1-1, pl 1-1, v 1-2; Mt d, pl and rl 1-1ap, v 2-2ap. As male, but abdomen sometimes larger. Coloration as in male, but abdominal pattern often richer, with additional white patches on sides (Figs. 4–6). Palps dark. Epigyne very small, with slightly elevated central part, copulatory openings placed laterally (Figs. 15–17). Internal structure simple; seminal ducts short and wide, receptacles kidney-shaped (Figs. 18–19).

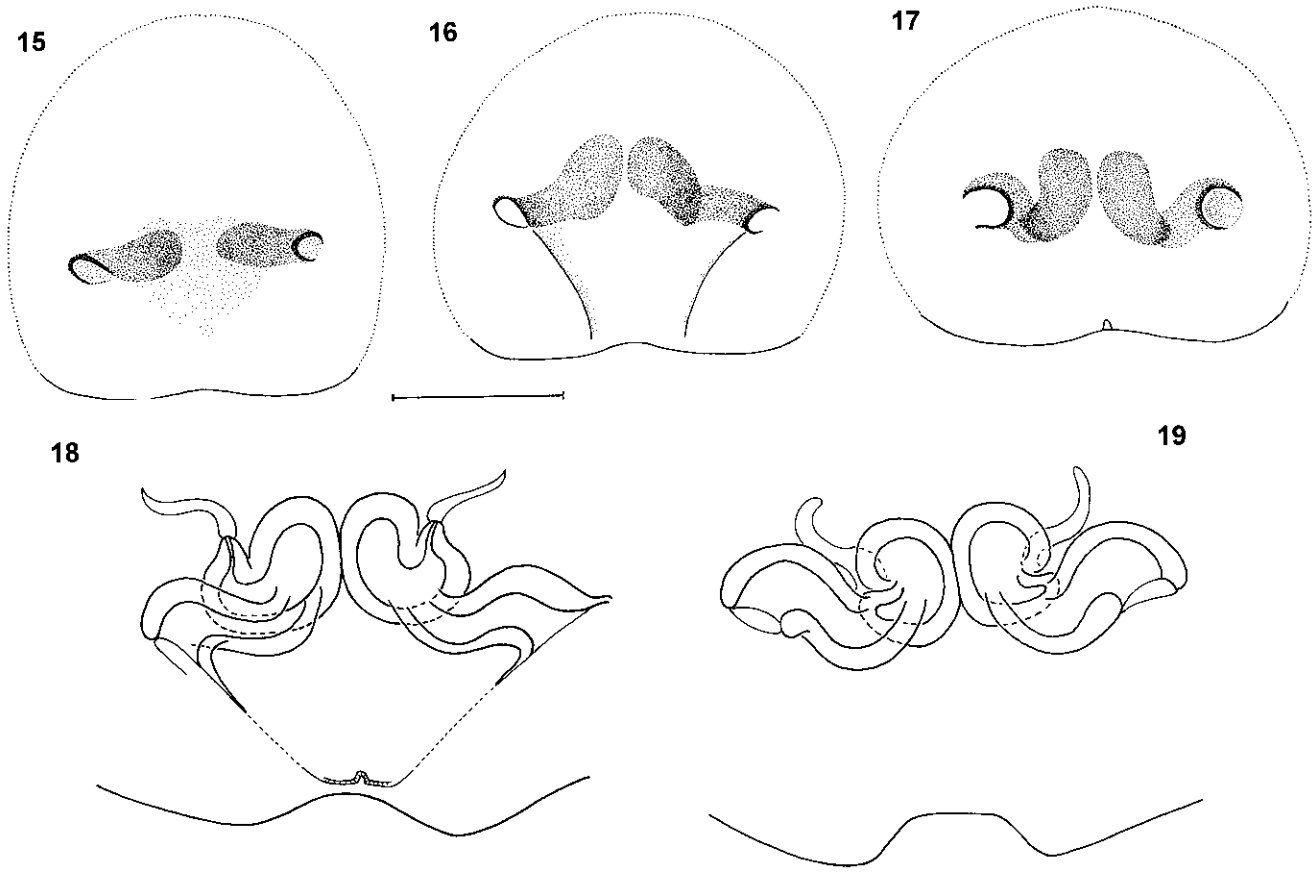
Juvenile: Early instar spiders are of similar coloration; differ from adults only in size.

Distribution: Namibia, Zambia and Zimbabwe.

Natural history

Habitat: *Mashonarus guttatus* has been collected widely in southern Africa under logs, stones and rocks (see notes on paratypes). In the Harare garden it was recorded a total of 94 times between April 1992 and November 2000. Of these sightings, 61 (65%) were in the vicinity of *O. transvaalensis* termite mounds, 8 were in old leaf litter, 7 on a compost pit and 6 on low green ground-cover. After rain, when the ground was very damp, it was seen occasionally on low vegetation such as grass, 4 times on garden walls at heights up to 2 m and once at the top of a 1.5 m plumbago bush.

Microclimate: *M. guttatus* has been captured in both drier and more moist regions of southern Africa, at both higher and lower altitudes (500–1500 m a.s.l.). In Harare, which is more moist and at a higher altitude, *M. guttatus* is most often seen in dappled light, under litter or in deep shade, rather than in direct sunlight. it



Figs. 15–19: *Mashonarus guttatus*, n. sp. **15–17** Epigyne; **18–19** Internal structure of epigyne, ventral view. Scale line=0.2 mm.

remained out of sight during wet weather, possibly for some weeks, and again during the cold of mid-winter. In the very wet summers of 1998/99 and 1999/2000 its numbers were low in Harare. The highest densities were recorded in the drought years of 1991/1993.

Retreats: When given a choice of building materials, under laboratory conditions, *M. guttatus* made its nest on the inside of the same rolled-up dry leaves among which it hunted. Retreats were free of litter fragments or soil particles. A nest containing eggs, placed in the gap between two loose bricks on a driveway, was made of dense, opaque silk.

Foraging and prey: *M. guttatus* searched for prey among ground litter, especially in dry rolled leaves, under termite galleries and tunnels of crusty carton (dried mud), and in cracks in the ground. It actively investigated coarse litter and termite feeding sites, often working its way from one side of a mound to the other. It was seen at new damp construction patches where builder termite workers exposed themselves. It grabbed termite workers without hesitation (ten observations), undeterred by their secretions or defensive behaviours. It was never seen to catch members of the soldier caste. Twice it was seen feeding on prey other than termites, once on a leaf-hopper nymph in a short-grass area and once on a fruitfly on a compost pit. Juveniles have not yet been recorded feeding on termites.

Predators: An *M. guttatus* exoskeleton was found (once) in a mud-dauber wasp's nest. The species was also likely to have been taken by resident territorial skinks which hunted salticids on the mounds, and by some of the many insectivorous birds attracted to *O. transvaalensis* termite mound chimneys.

Reproductive cycle: The seasonal growth pattern of this salticid is shown in Fig. 20. A nest with eggs and the mother inside was found on 27 November 1998. Juveniles appeared in spring and early summer (the hot dry season, extending from September to November) and even in December, after the first rains had fallen.

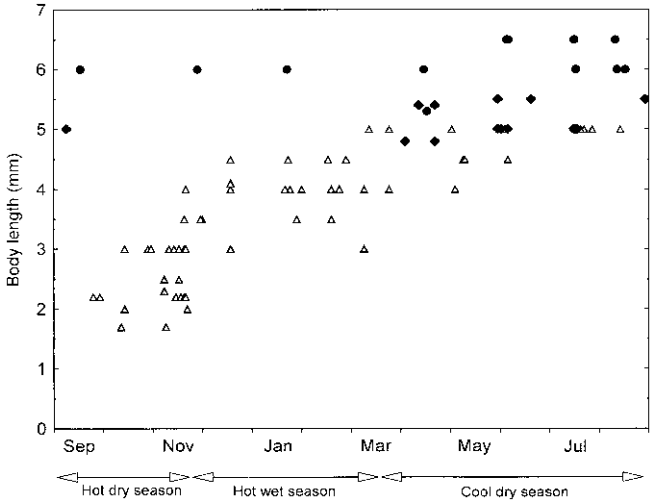


Fig. 20: Seasonal growth pattern of *Mashonarus guttatus* reflected by body length. Empty triangles=juveniles, filled circles=adult females, filled diamonds=adult males. Adults observed in September–January were survivors from the previous season.

Fig. 21: *Mashonarus guttatus*, n. sp. catching a termite.

During the rainy season, from December to March, all stages of immature spiders moulted and grew, feeding under suitable conditions but remaining out of sight when the ground was sodden. In any given year their activity varied according to the particular pattern of rainfall.

In April, at the end of the rains (autumn) and the start of the cold dry season (winter), their behaviour changed, at the onset of the mating season. Intraspecific male-male threat was observed on 21 April 1994, on a compost pit, with the males head-to-head, close together and legs I elevated and stretched forward. Only during April–June was *M. guttatus* found inside the vents of the termite mounds and all individuals involved were reproductives, both males and females. Between 11 and 23 April 1993, from 1200–1400h, on five days, up to three *M. guttatus* were present inside a mound vent, while on 15 May 1993 eight *M. guttatus* were mating, threatening and chasing each other. Simultaneously, large numbers of mating *Microheros termitophagus* were also present. The two species have overlapping mating periods and conflict between them was observed three times. On 29 May 1999 an adult male *M. termitophagus* hopped down the outside of a vent to confront, at close range and head-to-head, an adult male *M. guttatus* at the base; they feinted at each other with legs elevated, before the *M. termitophagus* turned and jumped away. Differences in posture between intra- and inter-specific threat were not recorded.

After the mating season old males and females survived for some months. Old (previous generation) specimens were easily recognisable because the bristles forming their white spots started to disappear. The longest-surviving female was seen on 21 January 1999, while the longest-surviving (but shorter-lived) adult male was seen on 8 September 1999. Although some of the previous year's adults were still present when juveniles hatched there was no overlap between adult generations.

M. guttatus were often observed in small groups, with several individuals in close proximity to one another. On 17 December 1999 a group of five immatures of different instars were all in the same short-grass area and on

20 November 2000 three specimens hopped around in a 20 × 20 cm open patch.

Biology of the two termitivorous salticid species — a comparison

The natural history and reproductive cycle of the first species, *Microheros termitophagus*, was given in Wesołowska & Cumming (1999).

Both species were usually found in the vicinity of *O. transvaalensis* mounds in the Harare garden, although *M. termitophagus* was more numerous. Whereas *M. guttatus* searched for prey at the base of mounds, off the vents, in litter and under termite galleries, *M. termitophagus* hunted termite workers inside the tall open vents at the apex of the same mounds.

Their retreats also differed: *M. guttatus* built nests of silk without inclusions, in dry rolled leaves, whereas *M. termitophagus* built below-ground nests, well camouflaged with soil and litter fragments.

Although neither species was seen during wet or cold weather, the presence of *M. termitophagus* was entirely dependent on very bright light, whereas *M. guttatus* hunted in more shaded places and in dimmer light.

The mating period of the two species largely overlapped (April/May). Such autumn mating is, however, very unusual among the other 36 salticid species found in the Harare garden. Only during that period did *M. guttatus* enter inside the open mound vents. At other times, from June to March, *M. guttatus* was never seen in the vents, whereas *M. termitophagus* stayed there during feeding sessions. Both species mated inside or on the outside of the vents, though they may also use other locations. *M. guttatus* may be attracted to the inside of the vent by the collective mating pheromones secreted by (up to 50) *M. termitophagus* during the mating season. The rim of the vent is then also thickly covered with *M. termitophagus* dragline silk. Pheromones in female draglines are found in various wandering spiders such as *Dolomedes triton* (Walck.) (Roland & Rovner, 1983), *Lycosa punctulata* Hentz (Tietjen & Rovner, 1980) and in some Salticidae (Jackson, 1987). The possibility exists that the reproductive pheromones of the one salticid species may act as a stimulant to the other, but this possibility has not been tested.

Although not closely related, the two termitivorous salticids have much in common and this raises the possibility that the termite-eating habit may result in convergent behaviour among its practitioners.

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