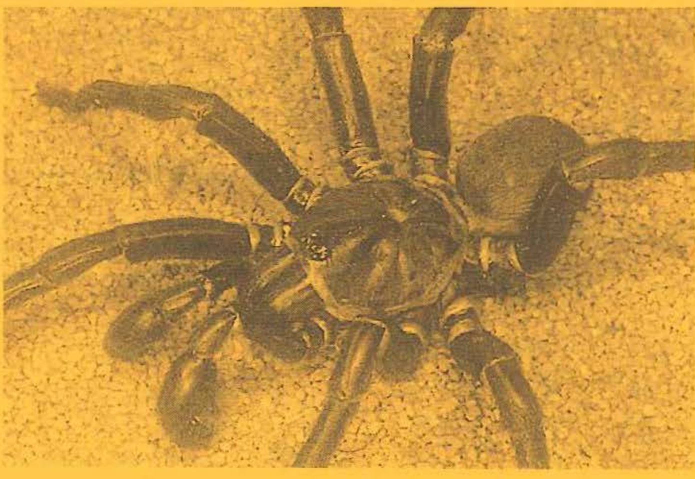
AUSTRALASIAN

ARACHNOLOGY



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THE AUSTRALASIAN ARACHNOLOGICAL SOCIETY

We aim to promote interest in the ecology, behaviour and taxonomy of arachnids of the Australasian region.

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Please send articles to the Editor:

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COVER PHOTOGRAPH by Matjaz Kuntner
Arbanitis variabilis ♂ from S.E. Qld.

EDITORIAL

Yes, another year has passed us by! And another four issues have passed too, so we now have a new taxon modelling the front cover. Perhaps my bias for strong sturdy mygalomorphs is showing, but I certainly liked this photo taken by Matjaz Kunter during his Australian visit. It is, however, important to raise the profile of mygales given the fact that species are at risk from increasing habitat loss and disturbance. This is especially the case in Queensland with current land use practices.

Covering a less obvious process threatening our beloved arachnids, is David Hirst's story on the European wasp in South Australia. Perhaps this story will encourage members to keep a look out for the effects of this sneaky predator or other feral invertebrates on our native faunas elsewhere.

Still in South Australia, Travis Gotch has provided us with an abstract from his honours research on Mound Spring lycosids. Travis enjoyed his project so much he has now gone on to do a PhD to study them in more detail, and we include an outline of that work as well.

The patient observations of Doug Wallace again offer us a wonderful insight into the antics of our spiders – this time a cryptic hersiliid! What else is hiding out there on the trees in your backyard?

........*Tracey*

MEMBERSHIP UPDATES

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Congratulations to:

Doug Wallace on his 80th Birthday!

Robert Raven on his 50th Birthday!

The European Wasp In Adelaide

David Hirst
South Australian Museum

To most people in Adelaide, South Australia, the European or German wasp, *Vespula germanica*, is little more than a nuisance at barbeques as it is attracted to sweet foods, soft drinks and meat. At worst, the wasp can be life threatening if one accidentally disturbs a nest. What most people may not appreciate, however, is that this introduced pest poses an unsurmountable threat to our invertebrate wildlife.

Adult wasps apparently subsist mainly on nectar and insect honeydew, the latter also being an important food source for other insects (Harris 1991). The bulk of prey taken by wasps are insects and spiders that are fed to the larvae. Prey biomass of wasps studied in some areas of New Zealand was similar to that of the entire insectivorous bird fauna (Harris 1991). Colonies of European wasps in Australia and New Zealand are many times larger than those found in Europe with more queens produced, and also, wasps have been reported preying on an endangered Tasmanian butterfly and the butterfly larvae. (Gullan 1999). In Melbourne, Victoria, wasps were recorded as preying on the leaf-curling spider, *Phonognatha graeffei* (Tetragnathidae) (Martin 1995).

In Adelaide the spread of the wasps immediately altered the arachnid fauna in my garden at Windsor Gardens with *Phonognatha graeffei* and the introduced harvestman, *Nelima doriae* disappearing altogether by the end of the Autumn of the first heavy infestation. I believe that occurred the second year the wasps were present in Adelaide. *Phonognatha* was always present during the first 14 years of my residing there and *Nelima* was the most common animal seen apart from the Portuguese millipede and wood lice. Neither arachnid has been seen in the seven to eight years since wasp occupancy.

While the loss of an introduced harvestman is possibly a bonus, it may well indicate that the native species still found on the eastern and southern outskirts of the city are disappearing equally as fast. Many other common spider species have been greatly reduced in numbers including *Stephanopis* sp. (Thomisidae), *Venatrix psuedospeciosa* and *Artoria* sp. (Lycosidae), *Breda jovialis*, *Helpis occidentalis* and *Sondra* sp. (Salticidae), *Oxyopes gracilipes* (Oxyopidae) and a small species of Zodariidae. All are now rarely, rather than often, seen.

Some of those spider species are diurnal (as are the wasps) or, of the nocturnal species, their diurnal retreat time is minimal. Wasps may fly low to the ground buzzing leaves in search of prey hiding beneath, or closely follow a branch of a shrub as they fly upwards to the tip before moving onto another branch or shrub.

An acquaintance has observed the wasps attacking black house spiders, *Badumna insignis*, on house walls chewing off the abdomen into a manageable piece to carry off to the nest. Larger spiders may escape the wasps attention, however the young are taken and fewer remain to reach maturity. Even the common orb-weavers (Araneidae) *Eriophora biapicata, Araneus eburnus*, and a species that I consider belonging to *Novakia*, are much less often seen than previously.

The 'pet' huntsmen (Sparassidae) I invariably keep at home are now solely relying on mealworms for food as moths flying to the rear porch-light have alarmingly dwindled in numbers. I have observed wasps attacking both moths and caterpillars. While I have seen wasps attacking other small invertebrates I have not been unable to ascertain their identity as the smaller size enables wasps to subdue it and fly off very quickly.

The apparent reduced number of invertebrates appears also to be affecting other types of fauna. Occasionally in the press over the last two years or so people have asked "where have all the sparrows gone". Some people are blaming exhaust fumes. However that will not explain why some other birds with similar feeding requirements, such as the blackbird, still abound. The answer seems simple: watch a sparrow hunt for insects and spiders and it is hunting in the same niches as the wasp, whereas blackbirds, dig into the litter and soil with their beaks where the wasps are unable to penetrate.

Admittedly, sparrows are only partly insectivorous, but the availability of their other sources of food is seasonal. It has also been reported in the press that the numbers of smaller native birds have been dwindling over the last ten years. Again I can see many species that are not dwindling are feeding on insects not targeted by wasps.

The threat posed to native fauna by the European wasp will ultimately include not just invertebrates but insect eating birds and may even extend further to flora reliant on insects for pollination.

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The Magic of *Tamopsis*

by Doug Wallace
Rockhampton, Queensland

After observing many remarkable spiders, it is evident to me that their diversities are never-ending, their habits eye-catching and at times, almost incredible. One example is the spider, *Tamopsis fickerti* (Koch, 1876) of the family Hersiliidae. The female body is only 7mm long, and that of the male, 4mm. The abdomen is flat and the legs very long. In colour, the spider is grey, brown or black, with all the different shadings in between depending on the colour of the spider's background.

Tamopsis is a bark dweller, living on tree trunks and branches, and is normally not noticed until it moves. The movement is rapid for a distance of about 30 cm, when the spider then needs a short rest for the tiny heart to recover from the effort.

The egg sac is a sphere, off-white and about half a centimetre in diameter. It is suspended on a thin stalk about one inch long, and attached at random on the trunks and branches of trees. The presence of the egg-sac, if they are not old and hatched, indicates the presence of the spider. The spider can then found by slowly stroking a long blade of grass over the bark, which disturbs her resting stance. At once she becomes evident by her very speedy movement as she escapes this unfamiliar menace!

Having found the spider, look closely at it from side-on and you will see the flatness of the body and the small protuberance on the head. Here, the eye group is easily seen to be higher than the rest of the spider and this positioning enables it to see over the top of the wrinkled bark as it awaits the approach of ants and other spiders.

The method of prey capture is startling, to say the least! Imagine *Tamopsis* as the minute hand of a clock, her head at the point of the hand, and her spinnerets at the end of her abdomen pointing to the hub of the clock. In this case, the hub is the prey. The spinnerets are as long as the abdomen and at the point of attack are opened wide in the shape of a 'vee'. On the inside faces of the long spinnerets there are specialised spigots from which the sticky silk is sprayed over the victim. She does this by spinning rapidly in a circle several times, pausing only to reverse direction, until the prey is firmly caught in the silk. She then reverses her body, bites the struggling prey, and once movement has ceased, begins to eat.

Discover this wonder by finding the egg-sac and plucking a blade of grass...and your patience will be rewarded!

POSTGRADUATE PROJECTS

Wolf Spider Assemblages in the Mound Springs and Bore drains of South Australia

Travis B. Gotch

Degree: Honours

Institution: Adelaide University.

Supervisor: Andrew Austin.

Submission Date: June 2000

Abstract: The mound springs of outback South Australia are unique wetland habitats located in the driest parts of Australia. They support a wide diversity of species and contain a disproportionate number of endemic and relict species than their area would suggest. The mound springs are the natural outflow of the Great Artesian Basin (GAB) and as such are potentially threatened by the use of GAB water for commercial applications.

The main use of GAB water is as a source of water for stock in the form of bore drains. These are bores that are allowed to flow out over the surrounding landscape creating a wetland which provides water, shelter and food for stock. Other uses of GAB water include irrigation of cotton and mining operations.

The threat to mound springs is from aquifer draw down (localised loss of aquifer pressure) caused from over use of the GAB. A recent program of bore drain closures was implemented by Western Mining Corporation (WMC) to free up water so that mining operations can be expanded without impacting on the mound springs. Faunal studies of mound springs have previously focused on aquatic invertebrates, however recent examination of the spider fauna highlighted the importance of wolf spiders (Lycosidae) within the springs. Few studies have examined the fauna of bore drains and fewer yet have compared the fauna of mound springs with the fauna of bore drains, despite their similarity. This study was initiated to examine the wolf spider assemblages within mound springs and bore drains and to examine any differences that occur between them.

This study identified seven species of wetland dependent lycosid. Mound spring lycosid populations were found to be more abundant and have higher species richness than in bore drains of a comparable area. Principal components analysis (PCA) of the distribution of mound springs and bore drains in spider space found that mound springs and bore drains could be distinguished based on their wetland dependent lycosid assemblage. A clear difference was observed between the relative abundance of *Venatrix arenaris* (Hogg) and *V. goyderi* (Hickman). *Venatrix arenaris* was found to be more abundant in mound springs while *V. goyderi* was more abundant in bore drains.

In addition to this, in springs and bore drains where these two species coexisted, an aversion pattern was observed with the two species partitioning into different microhabitats within the sites. Two conceptual models are proposed to attempt to explain the difference in abundance between *V. arenaris* and *V. goyderi*.

The dispersal, colonisation and genetic variation of Mound Spring lycosids

Travis B. Gotch
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Research Proposal for a Doctorate of Philosophy

Aims

The overall aim of this project is to examine the dispersal and colonisation of wetland dependent wolf spiders between Mound Springs and to examine the genetic diversity of spiders across the region.

The specific aims of the project are:

- to identify the species of lycosid spider associated with the South Australian Mound Springs, and determine their distribution, level of endemicity and to document the biology of the common species

- to determine the degree of relatedness among populations of the common species at different spatial scales (i.e. within spring groups and between distant springs)

- to examine the mechanisms of dispersal available to the Mound Spring lycosids

- to examine the metapopulation structure and dispersal patterns in a selected group of species and to determine movement patterns between springs.

Outcomes

The results of this project will be important in developing a management framework to conserve Mound Spring spider populations and provide a scientific basis for ongoing monitoring programs. This research will also make a fundamental contribution to better understanding the ecology and biodiversity of Mound Springs and will present a useful insight into the mechanisms of dispersal and colonisation between isolated terrestrial invertebrate populations. Further, the large number of specimens collected during this project will also make an important contribution in a project based at the Western Australian Museum on the taxonomy, phylogeny and biogeography of Australian lycosid spiders.

Site description

The South Australian arid zone occupies the northern two thirds of the state of South Australia. The study sites include

Mound Springs, wetlands and inland river systems that lie in the region bounded by longitude 135°00'E and 140°00'E and latitude 26°00'S and 25°45'S. Winter maximum daily temperatures average 23°C to 27°C across the study site, while in summer temperatures can exceed 50°C. The average annual rainfall within the study site is 100mm to 150mm. Actual rainfall events are unpredictable with frequent drought years interspersed with rare flood events more likely than regular rainfall.

The arid zone landscape is largely flat in relief with only the Davenport Ranges, Hermit Hill and sand dunes to break up the relief. The area consists of several ecotypes such as gibber plains, breakaway country, low dune country and sodic clay floodplains. Gibber plains are stone (gibber) covered deserts, sparsely vegetated with *Sclerolena* and ephemeral forbs and grasses. Breakaway country is the name given to the mesa like escarpments that fringe the Lake Eyre basin. These small escarpments often follow the edges of the shallow cretaceous period seas that once covered this area.

The classification of the springs utilises the spatial arrangement of the Mound Springs to identify each individual spring. Mound springs are classified into spring complexes, spring groups and individual spring vents. Spring complexes are large aggregations of spring vents that share a common artesian water source and chemistry. Spring groups are vents in close proximity that source their water from the same fault or fracture system. They tend to be very close to one another and often are connected along their tails. Individual vents within a spring group are considered the base unit when identifying springs.

Bore drains are in many ways analogous to Mound Springs. However, bore drains tend to be more isolated and due to the nature of their construction have different water chemistry to Mound Springs and are often hotter at the outflow (vent) region. Bore drains are also bigger than most Mound Springs and even the smallest are equal to a medium to large Mound Spring in area and water flow.

Methods

i) The taxonomy of Mound Spring Lycosidae their biology, distribution and level of endemicity

An initial pilot study sampled lycosid populations from 21 Mound Springs and five bore drains across the arc of the South Australian section of the Great Artesian Basin. Spiders were collected from these sites by actively searching during the day or by spotlighting at night.
I
Because of the numbers of vents in some spring groups, their close proximity to each other and the mobility of lycosid spider's, spring groups rather than individual vents are to be considered subpopulation units. To ensure that the sampling protocol does not under-represent the diversity of Mound Spring lycosids at each site three spring groups will be sampled at all vents and the minimum number of springs that need to be sampled will be determined. The amount of time spent sampling each spring will be standardised so that the

total time spent sampling is proportional to the spring's area.

A preliminary study on the systematics of the Mound Spring Lycosidae with Dr Volker Framenau revealed nine species associated with Mound Spring wetlands, including three previously undescribed species. Of the latter, one also represents a new genus which appears to be a Mound Spring endemic (the other eight species have been recorded from regions outside of the arid zone). Also, there is genetic evidence to support the establishment of a new cryptic species closely related to *Venatrix arenaris* (Hogg, 1905).

Previous research (Gotch 2000), as well as preliminary results from this study, show that *Artoria howquaensis* Framenau 2002, *V. arenaris* and *Venatrix fontis* Framenau & Vink, 2001 are the most abundant species at the Mound Springs. Of these, *V. fontis* is the most suitable exemplar species to further examine aspects of the biology and dispersal strategies of Mound Springs lycosids.

Further to this initial work, lycosid populations from another 37 Mound Springs and five bore drains will be sampled during the study. The collection of spiders from each site will be accompanied by the acquisition of biological and physical data from each spring and from the immediate vicinity of the spider (125mm radius). For each spring sampled the precise location and elevation of the vent, mid vent and base of the tail is to be recorded using kinematic GPS equipment. The height of vegetation at each elevation point is also to be collected. The statistics to be recorded at the point of capture are; time of capture, location within the spring where caught, vegetation type, vegetation density, vegetation cover, vegetation height, percentage of open space at ground level, substrate, soil moisture, free water depth and the percentage of free water cover. These data points are to be determined using a modified Point Grid Method. In addition to this, a detailed analysis of lycosid distribution within springs will be undertaken.

The springs will be sampled by setting transects every 2m along the tail. The transects are to be perpendicular to the flow and will be actively searched along their length. Lycosids within 250mm either side of the transect will be identified and there location marked with a numbered stake. After the spring has been sampled a detailed analysis of the area within a 125mm radius of the spider sighting will be carried out (as above). This information will be placed into a GIS database along with digitised aerial photographs. From this dataset raster maps will be generated to identify relative densities of spiders, favourable microhabitats and spatial variations between the different species.

Quantitative estimates of density in the optimal habitat areas indicated in the belt transect survey will be determined every three months using sampling quadrats 250mm x 250mm. For each transect, all spiders will be collected to determine size classes present and their abundance. Again the physical characteristics of the quadrat will be assessed, as above.

ii) The examination of the degree of relatedness between populations of Mound Spring lycosids at different spatial scales

To examine the relationships between the populations of lycosids the gene flow between spring populations at a variety of spatial scales will be determined. This is to be achieved using allozyme electrophoresis and mitochondrial DNA (mtDNA) sequencing. The electrophoretic part of the project will be undertaken at the Evolutionary Biology Unit, South Australian Museum in collaboration with Dr Mark Adams.

A previous examination of salt lake lycosids by Hudson and Adams (1996) identified 28 enzymes and other non-enzymic proteins with sufficient electrophoretic activity and resolution as genetic markers suitable for recognising cryptic species and for detecting major genetic differences between populations. Mitochondrial sequences will also be employed if electrophoretic data does not provide enough resolution for testing specific of hypotheses. This work, if required would be undertaken in collaboration with Dr Mark Dowton (The University of Adelaide) and Dr Steve Cooper (South Australian Museum).

A preliminary allozyme analysis on the tissue samples collected in the first survey screened 35 enzymes and non-enzymic proteins and found that for *V. fontis* there are 33 suitable for use as genetic markers, this exceeds the number of suitable markers found in Hudson and Adams (1996).

Venatrix fontis populations show evidence of restricted gene flow between spring groups indicating that populations are more isolated (i.e. have reduced dispersal capabilities) compared with the other species. Evidence of the presence of cryptic species within the Mound Springs was also found during this preliminary genetic study. Specimens of *V. arenaris* from the Avon River (Victoria), showed 33% fixed differences in allele frequencies compared with Mound Spring populations, indicating the latter probably represent a new cryptic species. This genetic analysis will be extended during the project to further support the associated study of the taxonomy of the Mound Spring lycosids. Therefore it will be necessary to collect specimens from areas outside the arid zone.

More detailed work will now focus on the genetic substructuring of *V. fontis* populations and will examine gene flow between sites at different spatial scales. Gene flow will be used to infer the movement of spiders between spring groups. The spatial scales will conform to the supergroup/complex/spring group arrangement described earlier. The sites have been selected to ensure that a hierarchical sampling protocol is followed with the minimum subpopulation unit to be the spring group.

iii) Examination of factors affecting dispersal and the mechanisms available to Mound Spring lycosids

A number of biological, behavioural and physical factors affect the ability of Mound Spring lycosids to disperse between springs including whether or not they can undertake ballooning, whether flooding events are responsible for dispersal and whether or not spiders are translocated by other species. To examine the importance these factors a number of experiments will be undertaken as described below.

Survivability of *Venatrix fontis* in the arid zone.

The length of time a spider can survive in the arid zone will affect its chances of dispersing between wetlands. An experiment that will investigate the survivability of spiders on different substrates will be carried out in the summer of 2002-03 and repeated in the following winter. Six treatments (under wet and dry conditions on sand, gibber and vegetated substrates) will be used, each replicated four times and arranged in a block design on a level surface. Each treatment will be contained in rectangular plastic tubs laid out near a Mound Spring. For the duration of the experiment environmental variables are to be recorded on dataloggers. Early instar juveniles of equal size class and adults will be tested separately.

Examination of spider ballooning.

The conditions that stimulate ballooning behaviour are well documented (Duffey 1956; Van Wingerden & Vugts 1974; Eberhard 1987; Bishop 1990; Suter 1991,1999). Experiments on early instar juveniles of *V. arenaris, V. fontis* and *A. howquaensis* will be conducted to determine the proportion of juveniles that can be stimulated to initiate ballooning. This will involve the construction of a ballooning chamber based on the design detailed in Eberhard (1987). Observations on the same three lycosid species in the field will be undertaken throughout the study during density sampling periods and will be achieved using sticky cane traps (Duffey 1956; Thorbek *et al.* 2002).

Effect of density on spider ballooning.

This experiment will determine if population density influences the frequency of dispersal by ballooning. The decision to initiate dispersal can be critical in determining the survival chances of an organism. Dispersal is risky especially if the chance of landing in a hostile environment is high. There are a number of factors that can influence this decision, such as availability of food, the risk of predation and the density of conspecifics (Horn & MacArthur 1972).. Within the Mound Springs the availability of prey is very high and not as likely to be as important as population density as a stimulus to disperse.

Venatrix fontis will be used for the experiment unless it proves to be difficult to stimulate the initiation of ballooning. Using the chamber described above the effects of varying densities of conspecifics on the frequency of ballooning will be examined.

iv) Examine the metapopulation structure and dispersal patterns in a selected group of species, tying it all together

Presence and absence data of Mound Spring lycosids collected during sampling will be used to create a simple metapopulation model. This model will be used to examine the inter-spring dynamics of lycosids and to identify source/sink populations within the springs. The model will be compared to the results of the gene flow analysis to assess the accuracy of the metapopulation model at predicting movement between subpopulations.

A GIS incorporating all of the data collected during the surveys, genetic analysis, physiological and behavioural experiments and the metapopulation model will be developed. The aim of this GIS is to examine the strategies used by the three main spider species, *V. arenaris*, *V. fontis* and *A. howquaensis*, employed to disperse from spring to spring and how this affects the population dynamics of Mound Spring lycosids.

It is intended that this GIS should highlight the most likely methods of dispersal employed by the various lycosid species and show directions of movement between spring groups. Other layers of the GIS will include, a digital elevation model (DEM). Part of the data to generate the DEM will be provided by WMC (Olympic Dam Operations) in the form of digitised aerial photographs and will be generated for the entire western catchment of Lake Eyre North and South. These will be converted to a DEM in collaboration with Dr Chris Wilcox (University of Queensland). The DEM in conjunction with the kinematic point elevation data will provide a detailed understanding of the drainage patterns and relationships between each spring within their respective catchments.

Other data to be incorporated into the GIS includes flood history and intensity, wind directions and other climatic data to be sourced from the Bureau of Meteorology.

The GIS model will be manipulated to simulate flooding events, thus determining the level of interconnectedness of isolated spring groups during such events. The GIS will also show clearly the effect of isolation and the spatial arrangement of the Mound Springs on the distribution of the Mound Spring lycosid populations.

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Editors note: the original length of this article was reduced and some methodological detail omitted for the purposes of this newsletter.