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SOME NOTES ON GROUND DWELLING MYGALOMORPH (ARANEAE) SPIDERS OF SRI LANKA

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INTRODUCTION

Mygalomorph spiders are a primitive clade of spiders that includes some of the largest and most fascinating spiders (*Poecilotheria*, *Chilobrachys etc.*) in the world. So far the suborder is represented by 16 families of which five families are present in Sri Lanka (Platnick, 2013). Most mygalomorph spiders are terrestrial and live in silk lined retreats, either in burrows of various shapes made in the soil or in sac like chambers made under rocks or tree trunks, with the exception of the genus *Poecilotheria* which belongs to the family Theraposidae which are the only primitive arboreal spiders present in south Asia (Nanayakkara, 2013). The burrowing species have a myriad of burrowing habits, some dig deep burrows which are 20 cm in length with many branches, whereas others dig much shallower retreats.

The families that have been so far reported from Sri Lanka are Nemesiidae (one species in one genus), Idiopidae (three species in two genera), Dipluridae (two species in one genus), Barychelidae (five species in four genera) and the more popularly known Theraposidae (seven species in three genera) (MOE, 2012). The spiders in the family Theraposidae have burrows with open entrances whereas the remaining families have trap doors which are made out of silk, soil particles and, in the case of some species, small pieces of foliage). Most species are nocturnal and hide during the day in the retreats. At night they wait at the entrance for passing prey or they wander around in search of food. They prey on a variety of insects and small animals and form an important part of the ecological food web. Mygalomorph spiders have been poorly studied in Sri Lanka, due to the inference of them being venomous and their nocturnal habits.

All the data presented herein were gathered by the present authors from 2009 to date. It was our intention to publish these mygalomorphs natural history observations after the revision of the suborder in Sri Lanka by us. We will not present detailed description of the species but rather give notes on the natural history and burrow types of the genera of mygalomorphs found on the island.

This paper, although greatly increasing what is known about the natural history and the burrowing habits of this neglected suborder in Sri Lanka, should be considered only a beginning, a foundation of observations and hypothesis which will, we hope, focus more attention on these fascinating spiders.

We also hope this paper will encourage and facilitate the conservation of these spiders and their habitats, which are rapidly shrinking due to urban, agricultural, and even recreational development. Regrettably, we have already witnessed the destruction of some habitats which we studied a year ago.

MATERIALS AND METHOD

The data used in this study was collected during field trips to study the genus *Poecilotheria*. The surveys were carried out at night since the focal species is nocturnal in habit. Once the burrows used by other mygalomorphs were observed the spiders were collected by adopting standard sampling techniques such as sweep netting, active searching and hand picking. Collected spiders were photographed in live condition, identified and then released to their natural habitat. The photographs of the specimens and their burrows were taken using a canon 550DSLR camera fitted with a macro lens. The burrow depths were measured using a yard stick, and possible natural history information were recorded. GPS coordinated were recorded using a Garmin etrex handheld GPS reciver. Most of the observation presented in this paper came from the wet zone of the Island.

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NATURAL HISTORY

The Mygalomorph spiders are a diverse group of spiders and most species live in silk-lined retreats. The retreats can either be verticle burrows or chambers made under rocks or under bark on trees. The retreats are left open or can be closed by a trapdoor . Extensions to the entrance frequently include lids, signal threads, collars, turrets or catch webs. These structures extend the range at which the substrate vibrations receptors located on the palps and legs of the spiders, can detect prey (Foelix, 1996). The capture of prey is done close to the entrance of the retreat. The construction of trapdoors and other structures around the retreats have evolved independently many times (Coyle *et al.*, 1992).

Most mygalomorphs are nocturnal and hide during the day in a retreat. However, some species such as *Chilobrachys*, come out of their retreat when they feel vibrations of prey at the entrance (during day light hours), this has been artificially stimulated by the authors to get *Chilobrachys* species to come out of the retreat to photograph. At night they lie and wait for prey at the entrance to the retreat.

MICROHABITAT

Burrows are made in a variety of microhabitats. The shape of the burrow and the microhabitat, in which it is made, differs between genera and families. However, all species prefer ground surfaces that are sheltered, relatively stable, sloping either east or northeast facing to otherwise shade. Burrows are seldom found in soil that is subjected to erosion, but rather in soil bound together by roots and/or sheltered under protruding roots or rocks. Although most species apparently prefer steep slopes such as ravine or road banks these retreats are usually found on slopes of 45° or less. These burrows are constructed in a wide variety of soil types ranging from soft sandy loam to hard clay loam that is often chunky or rocky. A thick layer of silk covers the inside walls of the burrow. The silk layer prevents the soil from caving in and renders a well-balanced microclimate. With some families, there is much variation in the soil types they inhabit. The depth of leaf and/or needle litter cover where burrows are found also varies greatly within the genera and within some species. While occupied banks are covered with little or no litter, the gentle slopes inhabited by some species may be covered with mosses (Bryophytes) or covered with up to 8 cm of litter. The spider normally digs only one hole during its life-time and enlarges it as it grows older. The depth of the burrow varies depending on obstacles in the ground, the size of the spider, hardness or softness of the substrate, soil type and slope of the ground. Although many burrows are classified as having a simple shape, the shape is often variable, depending on obstacles such as roots or pebbles that the spider encounters in the soil (Decae, 1996).

BURROW TYPES

Family Barychelidae

Variable silk-lined burrow with one or more entrances (Fig. 1) or entrance with leaf and/or grass-covered turret, or shallow retreat under stones with one or two trapdoors.

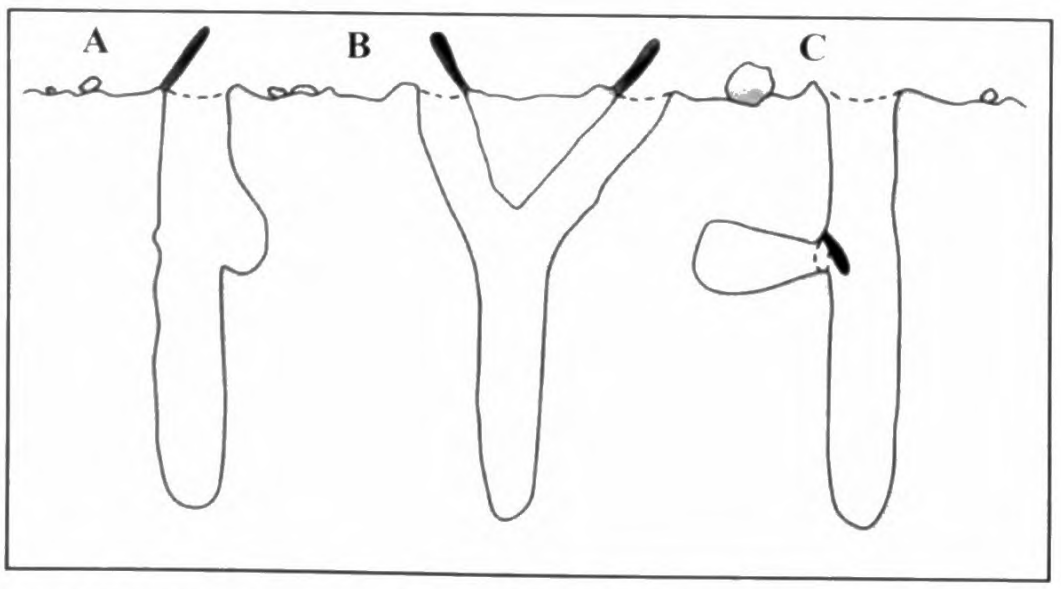

Fig. 1: Burrow of Barychelidae species, A. single burrow, B. Y-shaped burrow, C. burrow with side passage

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Natural History

Species that belong to the family Barychelids are mainly burrowing spiders and their burrows vary from temporary silk retreats to complex silk-lined burrows that are frequently covered with concealed trapdoors and make tubular retreats. Some burrows may be found in leaf litter attached to the underside of rocks or fallen trees (Raven, 1994).

Family Dipluridae

Tubular or funnel-shaped silk retreats made in crevices with entrance extending outwards to form irregular (Fig. 2), interconnected funnel- or sheet-like webs.

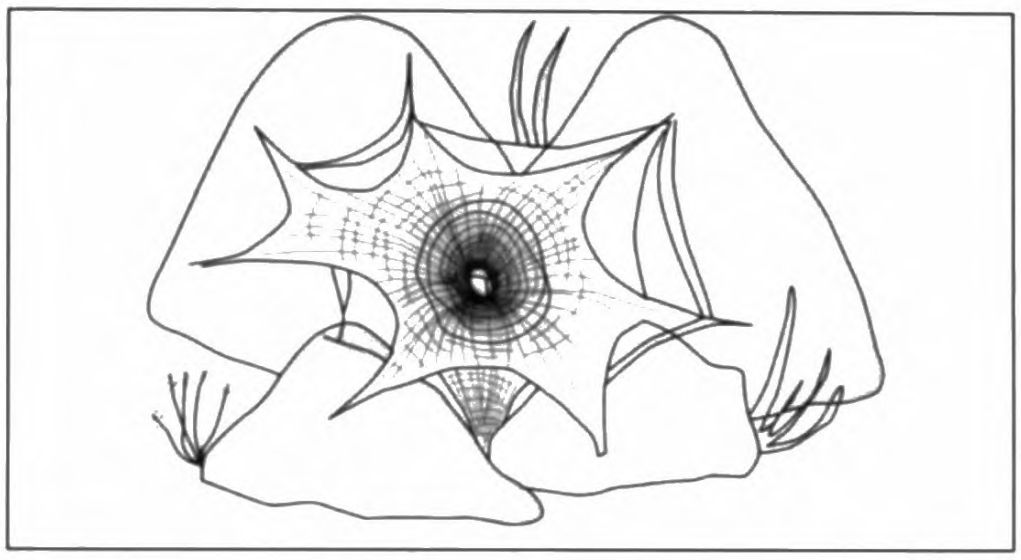

Fig. 2: Sheet web of a Diplurid spider

Natural History

Diplurid spiders use ill-defined sheet webs with a funnel like retreat to detect and capture prey in trees or from under stones, soil crevices, logs or moss mats or above-ground in protected spots at the base of plants. The spider hides in the retreat in one corner of the web. Some diplurids excavate burrows for a retreat but many do not (Coyle, 1986).

Family Idiopidae

Silk-lined burrows or chambers closed with wafer or cork like trapdoors (Fig. 3).

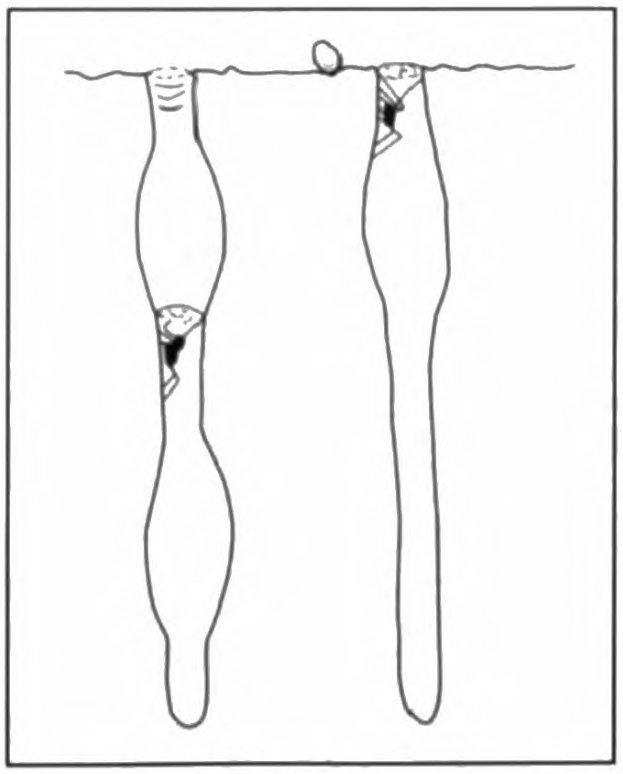

Fig. 3: Burrows of Idiopid spiders

Natural History

Idiopidae spiders close their burrows with a trapdoor hinged at one side with silk. The thickness of the lids varies from wafer-thin to thick and cork-like in appearance. The spiders are nocturnal and sit at the entrance of the burrows with the door slightly open, waiting for prey to pass by. If disturbed, the spider retreats into the burrow, closing the door tightly behind it. The males do not live permanently in burrows. But move around in search of females. The trapdoors to their burrows are constructed using the door moulding method. The trap door is well camouflaged with the door edges beveled and extending outwards to numerous closely spaced tabs made of silk.

Family Nemesiidae

Silk-lined burrows that are either simple or Y-shaped, or silk-lined tunnels and chambers made under rocks (Fig.4).

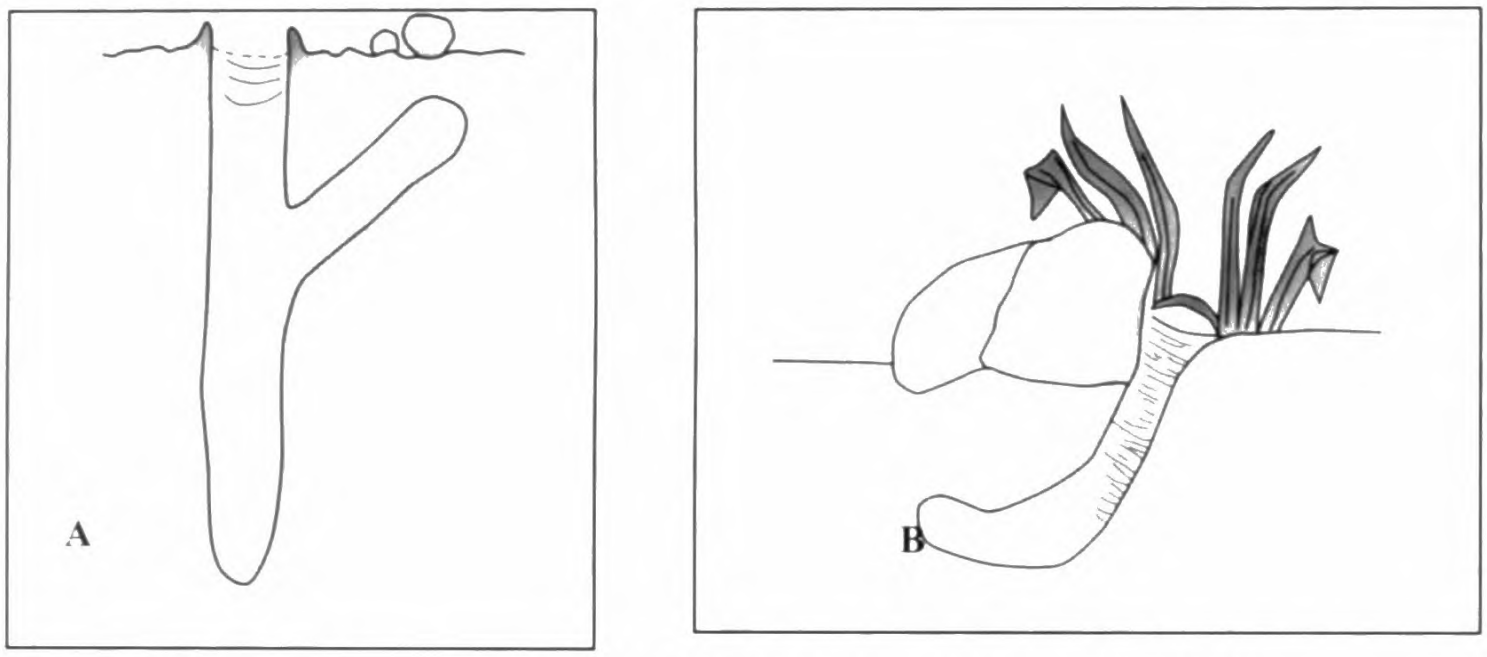

Fig. 4: Nemesiid burrows, A. Y–shaped burrow, B. Burrow underneath a rock

Natural History

Nemesiid spiders are known to live in silk-lined burrows that vary in shape from a simple deep burrow, to a Y-shaped burrow, to burrows with side passage or chambers made under rocks. Some members of this family make silk-lined tubes under or on the sides of rocks, or are found in silk webbing. Only a few species of this family are known to cover the entrance to the burrow with a lid. In most instances the entrances are without lids and flush with soil surface or rimmed with sticks and grass to form a turret.

Family Theraphosidae

Silk-lined burrows or silk-lined chambers made under rocks (Fig. 5), usually without a trapdoor but entrance covered with a thin layer of silk when not active.

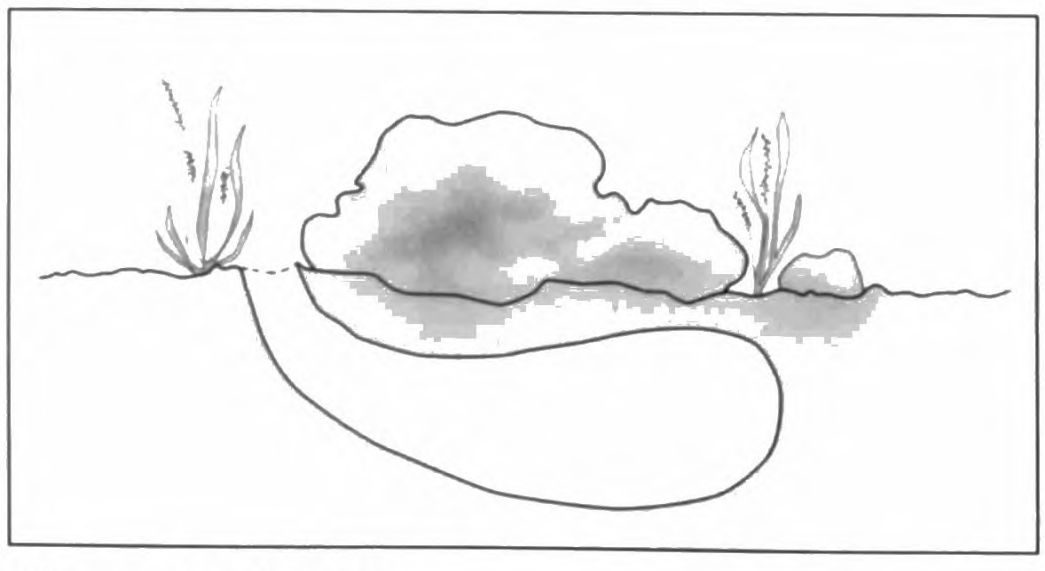

Fig. 5: Theraposidea burrow

Natural History

Burrowing Theraphosids in Sri Lanka include the genera *Chilobrachys* and *Plesiophrictus,* their burrows are usually deep. These burrows or retreats are silk-lined and found under stones and rocks. The silk lining usually extends beyond the entrance to form a silk rim that may assist in prey detection and that sometimes incorporate pieces of plant material. Theraposidae spiders are predominantly nocturnal 'sit and wait' hunters and most species await the approach of prey at the entrance of their burrows. Prey is usually captured at or near the entrance.

They presumably rely on sensory detection systems like trichobothria to detect air currents generated by moving prey, or soil and silk vibration detectors such as slit sensilla or club-shaped trichobothria (Foelix, 1996).

CONSERVATION

Like all other groups of taxa in Sri Lanka, mygalomorphs are also threatened due to habitat loss, fragmentation and the illegal collection for the pet trade. The mygalomorphs are steadily losing their foothold on the island. Development activities and encroachment of natural resources for products of commerce are taking its toll on the natural forest cover and secondary forest, while the fragmented habitat is getting altered. The impact of habitat loss and fragmentation is clearly visible in biodiversity rich areas of the wet zone in Sri Lanka. Hence, species, including the mega fauna, have declined in these areas over the years. Conservation efforts in the country have been focused on charismatic vertebrates, and the status of invertebrates such as mygalomorphs has been neglected, with hardly any attention being paid on their needs.

Fig. 6: Species of mygalomorph spider

Mygalomorphs are long-lived spiders that are poor at dispersal (Raven, 1980), and the species are restricted to few localities, this has been highlighted by the high endemism in the genus *Poecilotheria*, so far all species recorded from the island are endemic to Sri Lanka. Habitat alteration and degradation can have a major impact on small populations or highly localized species of mygalomorphs. For example a new species of *Chilobrachys* which was discovered by the authors is only found in a small forest patch in the wet zone and it is only found in steep banks that are covered with a type of Bryophyte (Fig. 6). Similarly, other new ground dwelling mygalomorphs were observed in small forested areas, this is a result of habitat loss and fragmentation; further the use of pesticides and insecticides is having a dire affect on ground dwelling mygalomorphs. Further, any changes in the habitat can wipe out a complete population, without ever being known to science.

The threats to these large bodied spiders are manifold. As in many cases, ground-burrowing mygalomorphs occupy roadside banks or mud bunds. And, very often, roadside banks are further cut for road developing activities such as maintenance and widening of the road. During this process, many burrows are destroyed, and often the spiders are killed, either by being buried or being crushed by the heavy machinery (Siliwal *et al.*, 2013). Further these activities result in significant changes in plant species composition, plant performance, and soil nutrient level. Due to myths and folklore surrounding these large bodied spiders and due to their imagined virulent venom and its effects on humans, these creatures are often killed by local villagers who find these spiders near human habitations or in forests. They do this mainly due to lack of education, as these spiders are in reality important biological control agents, making a significant contribution to the agriculture and the local populace. It is vitally important to educate the local community of the relevant areas on the need to conserve these creatures, as well as of the benefits that can be accrued from their presence and create awareness of the true facts and to dispel the myths (Benjamin *et al.*, 2012).The bite of a mygalomorph is very painful, but is not lethal to humans.

CONCLUSION

With the present revived interest in mygalomorph studies in Sri Lanka, more species are expected to be discovered. Along with the distribution and taxonomic studies, there is a need to take up conservation and ecology oriented studies on threatened mygalomorph species to ensure their survival in the wild. Sensitizing locals, foresters and decision makers can help the long term conservation of tarantulas who have an evolutionary history that dates back to the Cainozoic age, less than 65 Ma old (Selden *et al.*, 2009).

RECOMMENDATIONS

(1) It is necessary to enhance the capacity of mygalomorph taxonomists to undertake the much needed taxonomic revisions on spiders of Sri Lanka, through education and training

(2) It is paramount that local communities are educated on the important ecological role spiders play as biocontrol agents and bio indicators, and to educate them about the misconceptions related to the venomous nature of these spiders

(3) Develop user friendly field guides on both araneomorph and mygalomorph spiders to enable and popularize the study of these creatures

(4) Introduce agronomic practices that require a lesser usage of agrochemicals that are detrimental to spiders (and all fauna).

REFERENCES

Benjamin, Suresh P., Ranil P. Nanayakkara & Salindra K. Dayananda (2012). The Taxonomy and Conservation Status of the Spiders (Arachnida: Araneae) in Sri Lanka. In: *The National Red List of Sri Lanka; Conservation Status of the Fauna and Flora*. Weerakoon, D.K. & S. Wijesundara Eds., Ministry of Environment, Colombo, Sri Lanka. 42-44 pp.

Coyle, F.A. (1986). The role of silk in prey capture by non-araneomorph spiders, 269-305. In: Shear W.A. Ed.. Spiders: webs, behavior, and evolution. Stanford University Press, California.

Coyle, F.A., R.E. Dellinger & R.G. Bennett (1992). Retreat architecture and construction behaviour of an East African Idlopine trapdoor spider (Araneae, Idiopidae). *Bulletin of the Arachnological Society* 9: 99-104 pp.

Decae, A.E. (1996). Variation in burrow morphology of Mediterranean trapdoor spiders (Ctenizidae, Cyrtauchenildae, Nemesiidae). *Revue Suisse de zoologle* (hors serie):135-140 pp.

Foelix, Rainer F. (1996). Biology of Spiders (2nd ed.). Oxford University Press, Georg Thleme Veriag, Oxford, New York.

MOE (2012). The National Red List 2012 of Sri Lanka; Conservation Status of the Fauna and Flora. Ministry of Environment, Colombo, Sri Lanka. Viii+476pp.

Nanayakkara, Ranil P., (2013). Tiger Spiders of Sri Lanka; genus *Poecilotheria*. Loris, Journal of the Wildlife and Nature Protection Society of Sri Lanka. 26. (3&4). 53-54pp.

Platnick, N.I. (2013). *The world spider catalog, version 14.0. American Museum of Natural History*, [online] at American Museum of Natural History. Available at: <http://research.amnh.org/iz/spiders/catalog/.> Downloaded on 02 September 2013.

Raven, R.J. (1980). The evolution and biogeography of mygalomorph spider family Hexathelidae (Araneae, Chelicerata). *Journal of Arachnology* .8(3):251-266 pp.

Raven, R.J. (1994). Mygalomorph spiders of the Barychelidae in Australia and the Western Pacific. *Memoirs of the Queensland Museum.* 35:291-706pp.

Selden, Paul A., Heidi M. Anderso & John M. Anderson (2009). A review of the fossil record of spiders (Araneae) with special reference to Africa, and description of a new specimen from the Triassic Molteno formation of South Africa. *African Invertebrates.* 50 (1): 105-116pp.

Siliwal, Manju, Sanjay Molur & Robert Raven (2011). Mygalomorphs of India: An Overview. *ENVIS Bulletin: Arthropods and Their Conservation in India (Insects & Spiders).* 14 (1): 175-179pp.