

The supposedly unique case of *Cyrtocarenum cunicularium* (Olivier, 1811) (Araneae, Ctenizidae)

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Summary

Four fundamentally different methods of capturing prey have been described for trapdoor spiders (Ctenizidae). These have been proposed to reflect successive evolutionary phases of behaviour within the family. Only one representative (*Cyrtocarenum cunicularium* (Olivier, 1811)), which occurs on some of the Aegean Islands, has been reported to exhibit the most specialised hunting level. This species was reported by Erber to build a snare in which prey gets entangled. The study reported here is the first attempt to observe the general biology of this species since Erber's study in 1868. No evidence was found of web building, either in the field or in the laboratory. The results are discussed in relation to the evolution of hunting techniques in Ctenizidae.

Introduction

Trapdoor spiders (Ctenizidae) inhabit most of the tropical and subtropical areas of the world. In Europe they occur only in the countries bordering the Mediterranean and in Portugal.

Ctenizidae generally live in a burrow dug in the ground and most species close it off from the outside

with a trapdoor. This trapdoor is made of soil material, often clay, modelled into shape and reinforced with silk. The bottom of the door is covered with a sheet of silk which extends to one side to form the hinge and continues to, at least partially, line the walls of the burrow. The upper side of the trapdoor is very well camouflaged, being made of the same material as the surrounding soil and fitting perfectly in the burrow opening. A trapdoor spider generally digs only one hole in which it lives its whole life, enlarging it as it grows. Ctenizidae normally live for several years. For example, both *Anidiops villosus* (Rainbow) (see Main, 1978) and *Nemesia caementaria* (Latreille) (see Buchli, 1969) can probably live for approximately 20 years. Growth is associated with moulting as in other arthropods. This occurs at regular intervals throughout life. Little is known about the sexual behaviour of the Ctenizidae. Although females can reproduce more than once in a lifetime, males reproduce only once. Both sexes grow to maturity within a few years (5 or 6 years is probably normal).

In their hunting behaviour, four methods of capturing prey are generally recognised. These have been proposed to reflect the successive evolutionary phases of behaviour within this family (Buchli, 1969).

First, and regarded as the most primitive, are those spiders which will leave their burrows to pursue their prey. Buchli (1969) names three species of the genus *Nemesia* which have been observed to hunt in this way.

Second, the most common method of hunting for a ctenizid spider is to lie in wait behind a slightly opened trapdoor (e.g. *Cteniza* spp.). When a potential prey passes near enough to the burrow, these spiders leap upon it, flinging the door open in the process. They never leave the burrow completely while hunting, the claws of the last (fourth) pair of legs, at least, keep a grip on the rim. Consequently, the reach of the spider – the hunting area – is dependent on its size.

A third group uses an "early detection system" which effectively functions to increase the hunting area (Main, 1957, 1978). Some of these spiders assemble twigs or debris around their burrows, arranging it in a special way. The material is laid out in an open fan with the inner ends being spun into the collar of the burrow. When hunting, these spiders

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rest their legs on the proximal ends of this fan and can detect prey which touch the distal ends (Main, 1957). According to Buchli (1969) a European species, probably *Nemesia meridionalis* (Costa), appears to use silk strands in a similar fashion.

The fourth, and most specialised way of hunting is represented by the Greek trapdoor spider *Cyrtocarenum cunicularium* (Olivier, 1811). This is the only known ctenizid which has been reported to build a web. A web functions not only to warn the spider of the approach of a potential prey, it also prevents the prey from making an easy escape. The observations were made by J. Erber in 1868 on the island of Tinos. Erber (1868) in an elaborate description (of which Moggridge (1873) gives an English translation) states that a ribbon-shaped web is built shortly after nightfall every evening. It extends lengthways from the burrow for some 15 cm and is 1.5 cm high. After finishing the web the spider waits in the entrance of the opened burrow and runs out every time an insect gets entangled in the web. Each morning before sunrise the spider breaks down the web and takes it into the burrow, so that no trace of it can be found during daytime. This unique method of hunting has not been studied since Erber described it, although the behaviour is extraordinary for a ctenizid spider (Buchli, 1969). We have recently started a field and laboratory study on this species, the first results of which are described here.

Taxonomy

In spite of the work of several specialists in the field of arachnology during the last century, extant studies of European mygalomorphs – with the exception of the Atypidae (Kraus & Baur, 1974) – lack a satisfactory taxonomic basis.

Cyrtocarenum cunicularium was originally described by Olivier (1811) as *Mygale cunicularia*, a brown trapdoor spider, the burrow of which is commonly found in steep banks on the island of Naxos.

Specimens of a snare-building trapdoor spider collected by Erber on Tinos were classified by L. Koch (see Erber, 1868) as *Cteniza ariana* (Walck.). Ausserer (1871) erected the genus *Cyrtocarenum* to contain several species including *Mygale ariana* Walckenaer, which is a *nomen nudum* and synonymous with *Mygale cunicularia* Olivier (see Bonnet

(1956) for bibliography of the species). Ausserer listed the following five species of this genus found in Greece:

- (1) *C. arianum* (Walckenaer) 1805 on Naxos
- (2) *C. grajum* (C. L. Koch) 1836 from Nauplia
- (3) *C. hellenum* (Doleschall) 1852 on Corfu
- (4) *C. jonicum* (Saunders) 1839 from an unknown locality
- (5) *C. lapidarium* (Lucas) 1853 on Crete

Simon (1884) recognised the same species as Ausserer but called *C. arianum* *C. cunicularium* (Olivier).

After searching several islands of the Cyclades extensively in 1979, 1980 and 1981, it appeared that the trapdoor spiders found on Tinos, Syros, Paros and Naxos are morphologically indistinguishable and very probably belong to one species. One of our spiders collected on Tinos in 1979 was compared with specimens of *C. cunicularium* (Oliv.) and *C. jonicum* (Saunders) in the collection of the British Museum of Natural History and found to be obviously related to *Cyrtocarenum* species. Specimens collected from the four above mentioned islands were identified as *C. cunicularium* and *C. arianum* according to the classification tables of Simon (1884) and Ausserer (1871) respectively.

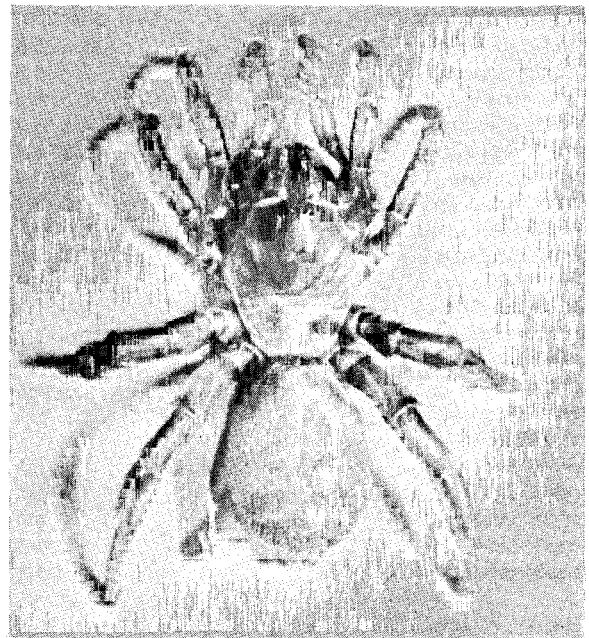


Fig. 1: *Cyrtocarenum cunicularium* female, dorsal view.

Unfortunately, it was impossible to compare our specimens with those originally collected by Erber as these have not yet been located. Efforts are still being made to carry out this check but these are obviously conditional on whether the original material still exists.*

Description

Adult female (male unknown)

Spiders are squat-bodied with stout legs (Fig. 1). Table 1 lists measurements with ranges and standard deviations for seven specimens. Carapace almost hairless; colour ranging from reddish to yellowish-brown. Fovea strongly procurved. Anterior median eyes dark, others with pearly lustre. Figure 2 shows the eye arrangement and Table 2 distances between eyes. Abdomen uniform earth-grey colour, no distinct markings; contractions of heart and pericardium outline visible in living spiders. Abdominal hairs of variable length and evenly spaced. Sternum same colour as carapace but covered with hairs of variable

*Any information with respect to this would be greatly appreciated.

	\bar{x}	s.d.	range
Total body length	25.0	1.2	23.6-26.6
Length carapace	8.5	0.5	7.7- 8.8
Width carapace	7.9	0.3	7.2- 8.3
Length chelicerae	4.9	0.4	4.5- 5.4
Length sternum	5.7	0.3	5.3- 6.1
Width clypeus	0.8	0.1	0.6- 1.0
Length femur palp	4.0	0.3	3.6- 4.3
Length patella palp	2.5	0.1	2.3- 2.7
Length tibia palp	2.2	0.1	2.0- 2.4
Length femur leg I	4.5	0.3	4.1- 5.0
Length patella leg I	3.5	0.2	3.1- 3.8
Length tibia leg I	2.9	0.2	2.6- 3.2
Length femur leg II	4.0	0.3	3.7- 4.5
Length patella leg II	3.2	0.3	2.8- 3.5
Length tibia leg II	2.4	0.2	2.2- 2.6
Length femur leg III	3.8	0.2	3.5- 4.1
Length patella leg III	3.5	0.2	3.2- 3.8
Length tibia leg III	2.0	0.2	1.8- 2.4
Length femur leg IV	5.7	0.4	5.1- 6.1
Length patella leg IV	3.9	0.2	3.6- 4.2
Length tibia leg IV	3.5	0.3	3.1- 3.8

Table 1: *C. cunicularium*, average measurements, standard deviations and ranges of selected body parts, in mm (based on 7 specimens).

	\bar{x}	s.d.	range
PLE-PLE	1.8	0.2	2.0-1.6
PME-PME	1.1	0.1	1.0-1.3
PLE-ALE	0.5	0.1	0.4-0.6
ALE-ALE	1.5	0.1	1.3-1.6
AME-AME	0.5	0.1	0.4-0.7
PME-AME	0.5	0.1	0.4-0.7
PLE-AME	0.9	0.1	0.8-0.9
PME-ALE	0.4	0.1	0.4-0.5

Table 2: *C. cunicularium*, average distances between eyes, with standard deviations and ranges, in mm. Measurements taken from eye centre to eye centre (see Fig. 2).

length. One pair of sternal sigilla. Labium separated from sternum by shallow groove.

Basal segment of chelicerae darker than carapace; thick row of dorsal spiny hairs along inner margin merging distally into heavy rastellar spines. Narrow dark stripe, containing sensory hairs, running lengthways over centre of lateral surface. Cheliceral furrow lined on each side with short blunt teeth and dense scopulae; minute knob-like teeth within furrow. Rastellum seen ventrally has two heavy teeth on a more or less triangular process, with third tooth laterally. Fangs short and blunt (see Figs. 3-5).

Legs and pedipalps similar in colour to carapace, with whiter regions at joints and covered with specialised sensilla. Excluding eyes, spider sensilla fall into two categories:

- (1) Setiform sensilla (hairlike structures)
- (2) Slit sensilla

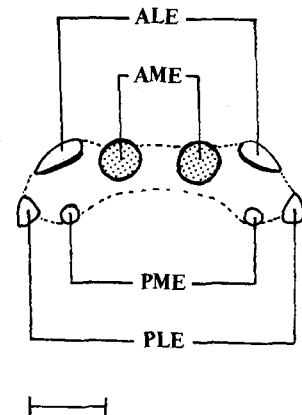
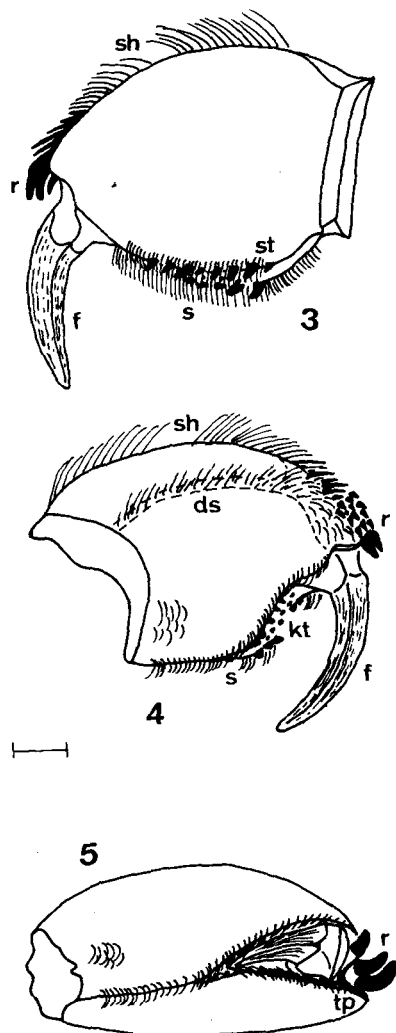


Fig. 2: *C. cunicularium*, eye formation. Scale line = 0.5 mm.

Five morphologically distinct setiform sensilla were seen and tentatively identified as spines, tactile hairs, trichobothria, chemoreceptor hairs and thermoreceptor hairs (see also Foelix & Chu-Wang, 1973a, b; Harris & Mill, 1977a, b; Den Otter, 1974). As these sensilla are currently being studied under scanning electron microscopy, further description will not be given here.



Figs. 3-5: *C. cunicularium*, chelicera. 3 Mesal view; 4 Lateral view; 5 Ventral view. (ds = dark stripe containing sensory hairs, f = fang, kt = knob-like teeth within furrow, r = rastellum, s = scopula, sh = spiny hairs, st = short blunt teeth, tp = triangular process). Scale line = 1 mm.

Legs and pedipalps bear single slits and lyriform organs. A lyriform organ on ventro-lateral side of patellae especially prominent.

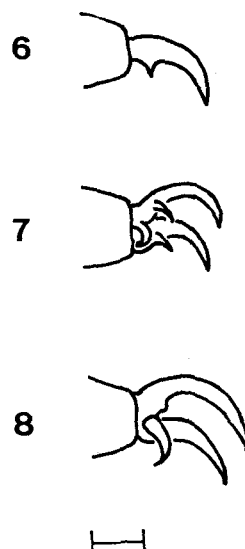
Ausserer (1871) and Simon (1884) used morphology of tarsal claws particularly to distinguish species of *Cyrtocarenum*. Although these agree in general with Ausserer's description for *Cyrtocarenum arianum* and Simon's for *Cyrtocarenum cunicularium* there is some variation making them less useful as taxonomic characteristics (see Figs. 6-8).

Spinnerets somewhat lighter coloured than abdomen. The two distal segments of lateral spinnerets together shorter than basal segment. Spigots found over whole ventral surface of spinnerets with two clear concentrations: one distally and one between the terminal and medial segments.

Leg formula: 4-1-3-2-palp. Lengths of legs 1, 2 and 3 differ very little.

Geographical distribution

Three visits were made to Greece in order to search for *C. cunicularium* and other Ctenizidae between 1979 and 1981. The search covered the eastern coastal regions of the Greek mainland and the Peloponnese from Thessaloniki in the north to Nauplion in the south, the Dodekanese islands of Rhodes, Kalimnos, Kos and Patmos and the Cyclades



Figs. 6-8: *C. cunicularium*, tarsal claws. 6 Palp; 7 Legs I, II and III; 8 Leg IV. Scale line 1 mm.

islands of Tinos, Syros, Naxos, Paros, Ios and Santorini. So far, Ctenizidae have been found only on the Peloponnese and on several but not all islands within the Cyclades.

C. cunicularium appears to be common on Tinos, Syros, Naxos and Paros but was not found at all on Ios or Santorini (Fig. 9). No other ctenizids were found on the Cyclades.

In the north-eastern part of the Peloponnese three different species of the family Ctenizidae were found, one of them clearly related to the Cyclades spiders. This is probably *C. grajum* which was described by C. L. Koch in 1836 (see Ausserer, 1871) from Nauplia (Nauplion).

Further, a small as yet unknown species of the genus *Nemesia* was found and one individual of a completely unidentifiable trapdoor spider.

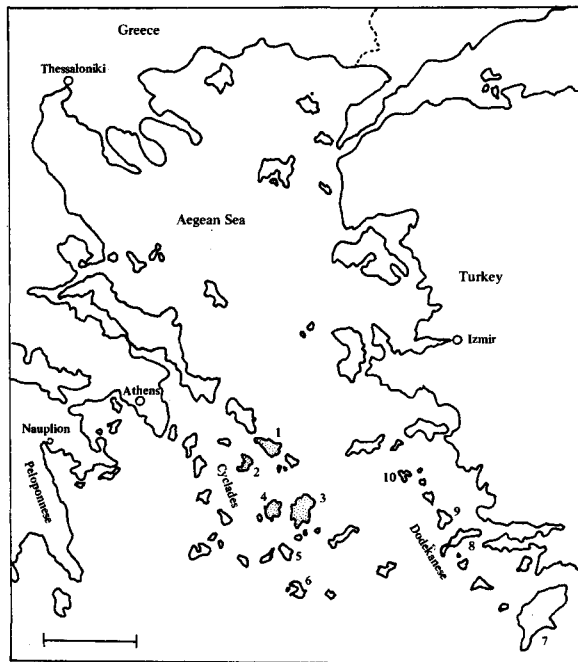


Fig. 9: Map of the Aegean area. *C. cunicularium* was found on the islands of Tinos (1), Syros (2), Naxos (3) and Paros (4) (all stippled) but could not be found on Ios (5), Santorini (6), Rhodes (7), Kos (8), Kalimnos (9) or Patmos (10). A related species, probably *C. grajum*, was found in the area of Nauplion. Scale line = 100 km.

General biology

Characteristics of the burrow

Structure

Although the nest of *C. cunicularium* is classified as a "simple burrow" (no side diggings, Comstock, 1965) closed by one "cork type" door, the shape is often complex owing to the many obstacles such as roots or pebbles which the spider encounters while building.

The bottom and inside walls of the burrow are lined with a thin sheet of silk which continues on one side of the burrow entrance into the silk covering the underside of the trapdoor, to form the hinge.

The depth of the burrow varies with the size of its inhabitant and also with the hardness of the substratum. Generally it is around 5 cm for the smallest spiders and around 25 cm for fully grown females. The diameter of the burrow may also be expected to be correlated with the size (and probably the age) of the spider. Some correlation has been found (e.g. Main, 1978, and Marples & Marples, cited in Main, 1978). Figure 10 shows a clear positive correlation between carapace length and burrow diameter (10 mm inside the shaft) for *C. cunicularium*. However, the standard deviations only allow separation of size-classes for spiders with a carapace length up to 8 mm. Above this there is considerable overlap. This agrees substantially with what Main (1978) found for *A. villosus*.

Construction

The spiders collected in 1979 and 1980, during

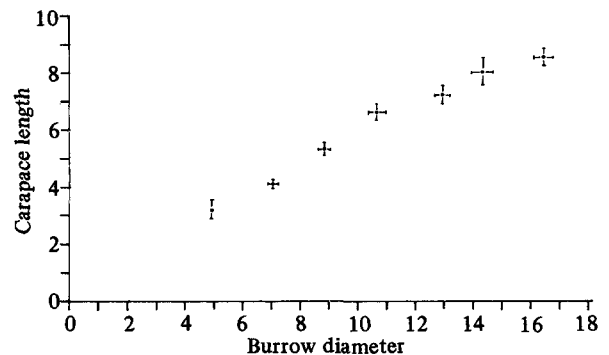


Fig. 10: Correlation between different size groups of *C. cunicularium* and the inside diameters of their burrows. Measurements in mm.

their aestivation period, were put into containers filled with clay soil in the laboratory. They all started digging a new burrow soon after. When they were given a free choice of where to dig, they almost always did so in a more or less sheltered position in the corners or near the walls of their containers. Sometimes they started their burrow in an already existing depression of the soil. This seems to correspond to what is found in the field where burrows are often found in the corners between stones or against the underside of stone walls, with few on open patches.

A marked difference was found between spiders caught from their own burrows and very young spiders taken from their mothers' nests. The former dug out a burrow but did not make a proper trapdoor, instead the burrow was closed by an irregular silk and clay plug. This plug was not replaced by a proper trapdoor until months later, in the period between the end of October and the end of January. This corresponds with the period when aestivation ends in the laboratory. Unfortunately, it is not yet known whether this is the same in the natural situation.

On the other hand the very young spiders built perfect miniature burrows (including trapdoors) within twenty-four hours. Door building starts with the spider attaching extra silk to the highest side of the burrow rim. This becomes the hinge and the door is built out slowly from here by successively moulding bits of clay to this silk and then attaching these with more silk. The spider carries up between the chelicerae grains of clay which have been dug from the bottom of the burrow. This clay is moulded with chelicerae, palps and front legs into the door under construction. After this the spider goes back into the burrow, turns 180° and comes out again, spinnerets first. The spinnerets move in a finger-like fashion along the moulded clay fastening it with silk. More clay is brought up in digging the burrow than is necessary for building the door. Unused grains are flicked away from between the chelicerae, landing some distance from the burrow.

Siting of burrows

Observations on *C. cunicularium* in natural situations show that at least two important conditions must be present on sites where burrows are found.

Firstly, there has to be a layer of soil thick enough to dig a burrow in (about 15 cm deep is probably the minimum). This is supported by laboratory observations where adult spiders were found to abandon partly completed, or even completed burrows within 4 cm of soil. Secondly, the area should not be densely overgrown with grass or scrub. There are several possible factors which may be involved here. For example, efficient door movement may be obstructed by plants, prey may be less abundant in such sites or more difficult to catch, etc. Furthermore, the spiders seem to favour a sloping surface in which to dig burrows. This is not a strict demand, however, as burrows are found in horizontal surfaces as well. The conditions required for the habitat and the geological structure of the islands therefore results in a patchy distribution of burrows. A good indication for the presence of burrows on a particular slope is the presence of moss and/or crustaceous lichen on the soil.

Another very important factor affecting the patchiness in distribution is local erosion. Old burrows projecting up to 5 cm out of the substrate were readily identifiable in such eroded areas. New burrows were never found on such sites.

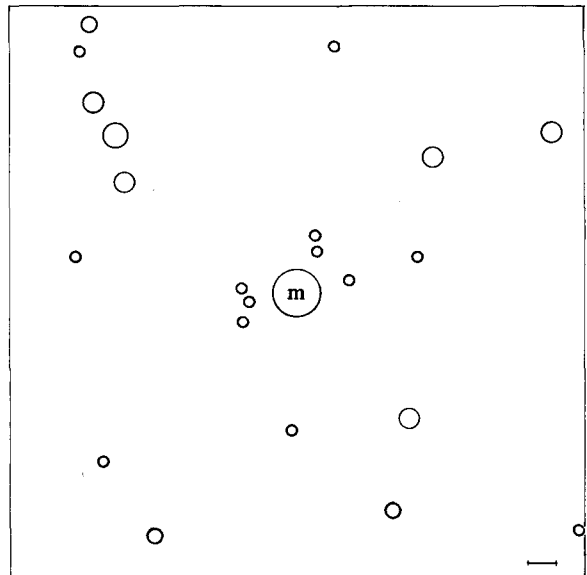


Fig. 11: Map of a 20 x 20 cm area around a central nest (m) containing a matriarch. All burrows are drawn to scale. The cluster was on a moss and lichen covered slope. Scale line = 1 cm.

Neither the actual type of soil nor the position of the slope with respect to wind direction seem to be important.

Local distribution

The spiders are aggregated in such a way that many burrows of juveniles are grouped around the burrow of an adult female (the matriarch in the cluster). When a matriarch has produced offspring more than once, several age-classes (3 to 7) can be recognised in one cluster. If a favourable patch of ground is big enough, several clusters may be found on it. Figure 11 shows how clusters are typically organised. Matriarchs in such situations are generally found at distances of 30-50 cm from each other. This is not always the case, however, sometimes two or three burrows of matriarchs are found very close together (distance only 2-15 cm). Such burrows are often approximately equal in diameter and may be occupied by spiders of the same age-group. This is difficult to verify, however, in view of the overlap in standard deviation among the larger spiders seen in Fig. 10.

Activity patterns

Circannual activity

Two distinct periods can be recognised in the yearly activity pattern of *C. cunicularium*. Firstly, a period in which daily activity includes behaviour performed at the burrow entrance, such as hunting. Secondly, a period after the trapdoor is sealed when the spider's activities are restricted to within the burrow. Such a period of relative inactivity during the warmer months is known from several species of Ctenizidae, e.g. *N. caementaria* (Buchli, 1969) and *A. villosus* (Main, 1978) and is usually described as "aestivation". Whereas feeding and, presumably, mating take place in the first period the spiders seem, superficially at least, to be inactive during aestivation. However, moulting and egg-laying are known to occur during this period. Moreover, laboratory observations with "see-through burrows" reveal that the spiders are not totally inactive during this period.

Field observations show that there is a difference between age-groups with respect to onset of aestivation. Smaller spiders start their aestivation before bigger spiders (see Fig. 12). B. Y. Main (pers. comm.)

suggests that smaller spiders may be more sensitive to higher temperature and reduced humidity which could stimulate them to aestivate sooner.

Daily activity

When not in aestivation the spiders come to the entrance of the burrow at night and push the trapdoor into an "ajar-position". They stay directly under the trapdoor in this hunting position all night, retiring shortly after dawn. Retraction into the burrow also occurs during the night, for a short period at least, after prey capture and sometimes owing to disturbance.

Feeding behaviour

More than one hundred hours have been spent watching the hunting behaviour of a large number of *C. cunicularium*, both under natural conditions and in the laboratory. Observations were made during the day and night. Particular attention was paid to the latter period as, not only are the spiders active only during this time, but this is when Erber reported seeing web building. The behaviour which we observed was typical of that of an ambush predator. The spider springs from behind the trapdoor onto potential prey animals that pass nearby. It was never seen to leave the burrow completely in a prey catching attempt. Figures 13-15 show a sequence of prey catching actions of *C. cunicularium* recorded in the field.

Prey are probably detected by the vibrations they create in the soil while walking. In the laboratory,

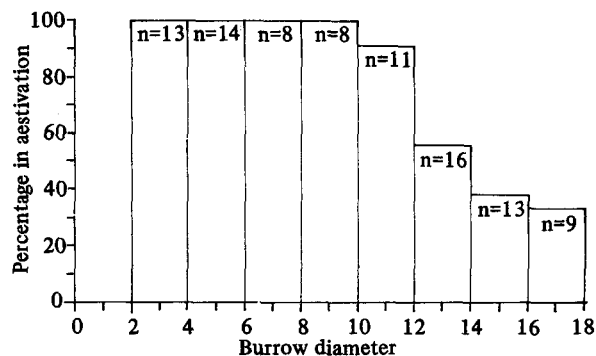


Fig. 12: Percentage of *C. cunicularium* in different size groups found in aestivation during the period 8-19 May, 1981. Measurements in mm.

slight vibrations of low frequency (between 1 and 100 Hz) applied to the soil with the aid of a piece of metal wire can provoke a "hunting jump" from a spider as it lies in wait behind a slightly opened trapdoor.

Feeding does not necessarily inhibit hunting behaviour. After catching a prey the spider retreats into the burrow for some time. Consuming an average sized prey takes approximately 6.5 hours, but a spider can often be found in the hunting position again shortly after prey capture. Moreover, in the laboratory one spider was seen to catch a second fly while still holding the first one in its fangs.

Prey remains are always disposed of outside the burrow. The spider achieves this in the same way as it disposes of pellets of clay, flicking it a considerable distance from the burrow after first making it into a ball.

Natural prey

In general, owing to their fossorial existence and ambushing tactics, trapdoor spiders cannot afford to be very selective about their diet. They are entirely dependent for their food on small animals that happen to wander into strike range of their burrows. In the laboratory as well as in the field it was found

that a range of small arthropods could function as prey. The size of the prey seems to be more important than the sort in determining whether the spider reacts or not. In the field, however, it was found that certain bed-bugs (Fam. Reduviidae) that were within the size limits for potential prey, were not attacked. This might be due to a repellent smell (Chinery, 1975). Prey size limit varies with the size of the spider. For instance, while *Drosophila melanogaster* (length ca 2.5 mm) are readily accepted as prey by very young spiders in the laboratory, they are ignored by adult spiders. In the field it was found that spiders attack and catch various species of beetles (Carabidae) and woodlice (Oniscoidea) when they are smaller than 14 mm in length. Attacks on longer beetles as well as on woodlice (18-20 mm long) have been observed but the spiders withdrew into their burrows rather quickly after grabbing, touching and releasing these animals. It seems plausible to suggest that the most common nocturnally active arthropod species fitting within the size limits for prey acceptance, serve as the main prey. In early May a small species of woodlouse, 6-12 mm long, was found to be very common on Tinos. From experiments, it could be calculated that 45% to 70% of the prey captures at this time of the year are probably woodlice. Other



13



14



15

Figs. 13-15: Photographs taken at night of *C. cunicularium* catching a woodlouse (Oniscoidea). 13 A woodlouse wanders near the hunting area of an active spider; 14 The woodlouse enters the hunting area, the spider jumps but fails to grab the woodlouse which is thrown on its back; 15 After raking the area the spider finds the woodlouse and drags it into the burrow.

important prey animals are ants, spiders and beetles.

Discussion

As mentioned above, this paper presents the first results of a study on the Greek trapdoor spider *C. cunicularium*.

In starting a study on European Mygalomorphae in general, it soon became clear how little work has been done on this group. Owing to a vague taxonomic basis it is often impossible to name a spider with confidence. Males and females of the same species are described under different names, the males of several species are unknown, the morphological features used to discriminate species appear to be variable and probably there are species that have not yet been described.

As yet little is known about which species occur in Europe, and even less information is available on other biological characteristics of this group. To our knowledge, only Buchli's studies, mainly on the French trapdoor spider *N. caementaria*, give good and extensive information on the hunting behaviour of a European ctenizid.

Apart from this, the only other elaborate description of hunting behaviour is for the Greek spider *C. cunicularium*, which was, as stated earlier, given by Erber in 1868. His description is of particular interest because Erber claimed to have observed that this species shows a very specialised form of hunting behaviour, which is unknown in any other trapdoor spider in the world.

C. cunicularium was reported to build a web in which beetles become entangled before being seized by the spider. In building a web, the species would hold a unique position in the fourth evolutionary level presented in the introduction. Erber's description of the web building event becomes even more exciting when it appears that *C. cunicularium* not only builds a web, but builds a very unusual web. According to Buchli's interpretation of Erber's description it is a more or less rectangular "sheet-web". Erber's original report stated that the web is placed vertically, rather like a tennis-net. The threads in the web become more densely packed* from top to bottom.

Such a "ribbon-web" could possibly be seen as intermediate between the silken trip-wires of for instance the primitive Liphistiidae and the sheet-

and funnel-webs of the most specialised Mygalomorphae, the Dipluridae. On these grounds *C. cunicularium*'s hunting behaviour fell into the category of a missing link, a popular aspect of evolutionary studies in Erber's time. The possibility of Erber having observed a different species on Tinos must be considered as very unlikely. In three successive years (1979-1981) thorough searches for trapdoor spiders on the rather small island (195 km²) yielded only one species. Collected spiders, like those captured by Erber in 1868, were identified as belonging to the genus *Cyrtocarenum*. Specimens of the *Cyrtocarenum* species collected by us from Tinos are of a sort of trapdoor spider which occurs frequently on the island, making it all the more likely that Erber, in stating that it needs a good deal of practice just to find a trapdoor spider, found the common species.

Reading the circumstantial description of the night observation which Erber made on Tinos it is interesting to note that, with regard to general biological information like the characteristics of the burrow (no remains of prey, cork-type door up to 10 mm thick, smallest burrows up to 7.5 cm deep), and times at which the spiders are active, his observations agree fully with ours. Where Erber reports on the actual hunting behaviour and disposal of prey remains, however, his findings differ totally from our recent observations and appear to be fallacious.

Considering its hunting behaviour, *C. cunicularium* is a typical ambushing trapdoor spider and thus fits perfectly into the second evolutionary phase group.

As stated earlier, it has been hypothesised that there are four phases in the evolution of hunting behaviour within the family Ctenizidae: free hunters; ambushers which never leave the burrow while hunting; early warning system builders; and web builders with only one known representative species — *C. cunicularium*. From the results of our recent investigations into the prey catching activities of this species it must be concluded that, at present, there is no reason to suggest the fourth evolutionary level of web building as occurring within the Ctenizidae. Nevertheless, the three remaining hunting techniques of these obscure creatures, which combine many primitive spider characteristics with some very specialised ones, make the Ctenizidae a highly interesting group of animals which deserve more zoological attention than they have had in the past.

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