

NOTES ON THE BIOLOGY OF ARCTOSEIUS CETRATUS (SELLNICK)  
(MESOSTIGMATA : ASCIDAE)

BY

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DISTRIBUTION & HABITAT :

LINDQUIST (1961) commented that although *Arctoseius cetratus* (Sellnick) had been known since 1940 almost nothing has been written about its habits as a living organism. *A. cetratus*, formerly *Lasioseius cetratus*, was first recorded from old hay in Iceland (SELLNICK, 1940) and was taken, again as *L. cetratus*, at c. 3,000 m in wet moss and tufts of small plants in Switzerland (SCHWEITZER, 1949). COSTA (1961) found it, along with mites of many other species, in vole nests in Israel. EVANS (1954) described it, as *A. haplopius*, from under spruce in S. Beds., England. KARG, (1961) found many individuals in both grassland and arable soils, while Bernhard (1963) described it as a common species in compost, light woodland turf, *Calluna* and *Sphagnum*. LINDQUIST (1961) noted that the species had been collected from farm and rangeland soils from various parts of the United States including California, but that it had not been collected in more northerly parts of America. The best described location was given by WEIS-FOGH (1947) who identified the mite (as *A. bispinatus*) in 64 % of samples collected from poor pasture over sand with a dense, superficial root mat of *Carex* and *Hieracium*. Low lying areas subject to seasonal flooding were mostly, but not entirely, favoured. The dominant accompanying species were the oribatids *Malacoethrus globiger* and *Tectocephus velatus*, the collembolans *Hypogastrura armata* and *Folsomia quadriocollata* and enchytraeids. Dipterous larvae (see below), were few. BINNS (1973 II) found c 1,000 females/ft<sup>2</sup> in the upper layers of mushroom beds. Cf. Hussey, 1969. In general, females tend to predominate in collections of this genus (SELLNICK, 1940 ; WEIS-FOGH, 1949 ; LINDQUIST, 1961).

PREDATION AND PHORESY :

Feeding tests (KARG, 1961) showed that collembola, oribatid and acarid mites were accepted (see also WEIS-FOGH, 1947 and HUSSEY, 1969). BINNS (1972 ; 1973 (II) showed that mushroom mites, nematodes the eggs and larvae of the mushroom sciarid *Lycoriella auripila* Winn. were preyed on. A well developed phoretic association was discovered between the female mites and the sciarid (BINNS, 1972 ; 1973 (II). A single female sciarid carrying *A. cetratus* has also been taken outdoors in January, while SÖMMERMAA (1973) collected four *A. cetratus* from flies taken over clover ley. SOUTHWOOD (1962) considered that phoretic associations of female individuals provided evidence for the colonisation of new environments by migration (cf. BINNS, 1975). No other phoretic associations are known within this genus though an arctoseiine close to *Zerconopsis*

*decemremiger* (EVANS & HYATT, associates with crane flies from *Polyporus* bracket fungi (LINDQUIST, E., personal communication), while WHITSEL & SCHOEPPNER (1973) found two species of *Iphidozercon* associating with psychodids taken in light traps.

METHODS :

The basic mass-rearing container was a 60cc polyethylene screwtop pot half-filled with a 9 : 1 mixture of plaster of Paris and activated charcoal powder moistened in use, but without mould inhibitors. Sciarid eggs, collected from laying cages described by BINNS (1973 (1), were added in large numbers together with nematodes reared on porridge oats or Carolina Instant *Drosophila* medium (Gerrard and Haig, East Preston, Sussex), over moist sand (SINGER & KRANZ, 1967). The latter medium successfully resisted mould growth. Individual mites were observed while confined in 1 cm diam. cells or depressions drilled into a block of plaster/charcoal mixture (cf.

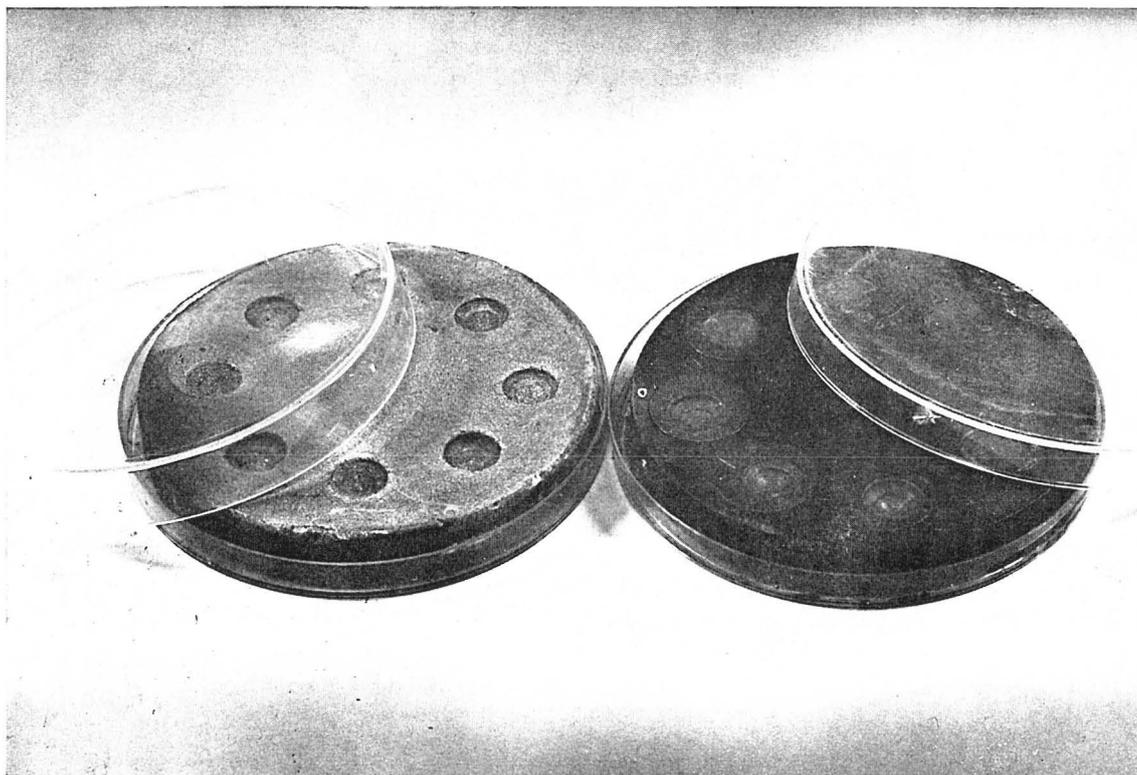


FIG. 1 : Simple plastic of Paris cells for the Maning and observation of individual *Arctoseius cetratus*.

EDWARDS, 1955). The block was cast in the base of a 9 cm polystyrene Petri dish. A series of cells was then drilled through the polystyrene mould which was finally removed. Each cell was sealed with a 19 mm circular microscope cover-glass held in place by its own weight. The whole block stood in an inverted Petri dish lid and was held in place by two wedges. These also prevented jamming of a Petri dish base which covered the whole (Fig. 1). Water could be added to the lower dish but excess water tended to prevent the removal of the cover-glass through surface tension. Precise machining enabled mite-proof cells to be made without the use of cement (SCHALLER, 1953) or petroleum jelly.

BIOLOGY OF FEMALES.

Phoretic individuals of *A. cetratus* were all fertile females (see below). Hosts taken from mushroom houses and placed in rearing pots began to lay on decapitation and free mites could soon be collected. However, caging mite-bearing flies over sciarid eggs for 24 h showed that detachment of the mites was not immediate (GREENBERG, 1961).

Each mite was red-brown, transparent and dorso-ventrally flattened. The idiosoma was convex above and concave below with the lateral digestive tracts clearly visible as elongate white sacs. Examination of 36 phoretic females immediately after detachment from the host revealed no trace of mature eggs. Feeding began immediately after detachment and, after 24h, the idiosoma became globular and opaquely white. The margins of the dorsal plate then became distinct. The first eggs were found within 24h of detachment and both male and female progeny were produced.

MATING :

Males pursued females and deutonymphs, palpating the idiosoma with the forelegs when contact was made. Males were introduced to five laboratory reared females 10 days after the latter had become mature. All five pairs mated immediately, the males "palpating" the female from behind and continued as described by ELBADRY & ELBENHAWY (1968), sliding beneath the idiosoma from the rear and holding the dorsal edge of the idiosoma with the hind legs. Pairs remained *in copula* for 4-5 min. Immediately after mating females refused further attention by rapid locomotion or upward "heaving" of the idiosoma. Two eggs were laid by five females within 2 days of mating. Gravid females appeared even more distended than freshly fed females until fecundity fell after 2 wk. (see below).

OVIPOSITION :

Two groups of eight phoretic females were observed in each test. The results of the most successful will be reported. In a pre-test period of 3 days, during which the eggs were allowed to accumulate in the cells, 16 mites laid 111 eggs or 2.3 eggs/female/day (with the highest individual total of 3.3 eggs/day). This compared with 1.3, 2.5 and 2.63 eggs/female/day for 104, 12 and 48 mite days on other tests. During the first test the mean number of eggs/day declined thus : 2, 2.75, 3.7, 2.5, 1.8, 1.5, 1.86, 1.76, 1.25 eggs/female/day on successive days during the test period when eggs were removed daily. During the whole period, 344 eggs were laid in 137 mite days giving a mean of 2.5 eggs/mite/day. The highest day's total was 13 eggs from 1 female, others laying 10 (1 female), 9 (×3), 8 (×1), 7 (×1), 6 (×2) eggs per day maximum. The highest individual total was 41 eggs in 9 days or 4.55 eggs/day. Two individuals died and two escaped during the test period and were replaced with comparable females.

Phoretic females allowed access only to nematodes as food showed a high mortality. Thus six out of 16 females died within 10 days of encapsulation (cf. below). Though eggs were laid, none of the females showed the same degree of distention as those fed on sciarid eggs and only 28 eggs were laid by 8 females over a 7-day period beginning 10 days after encapsulation (or 0.35/female/day.)

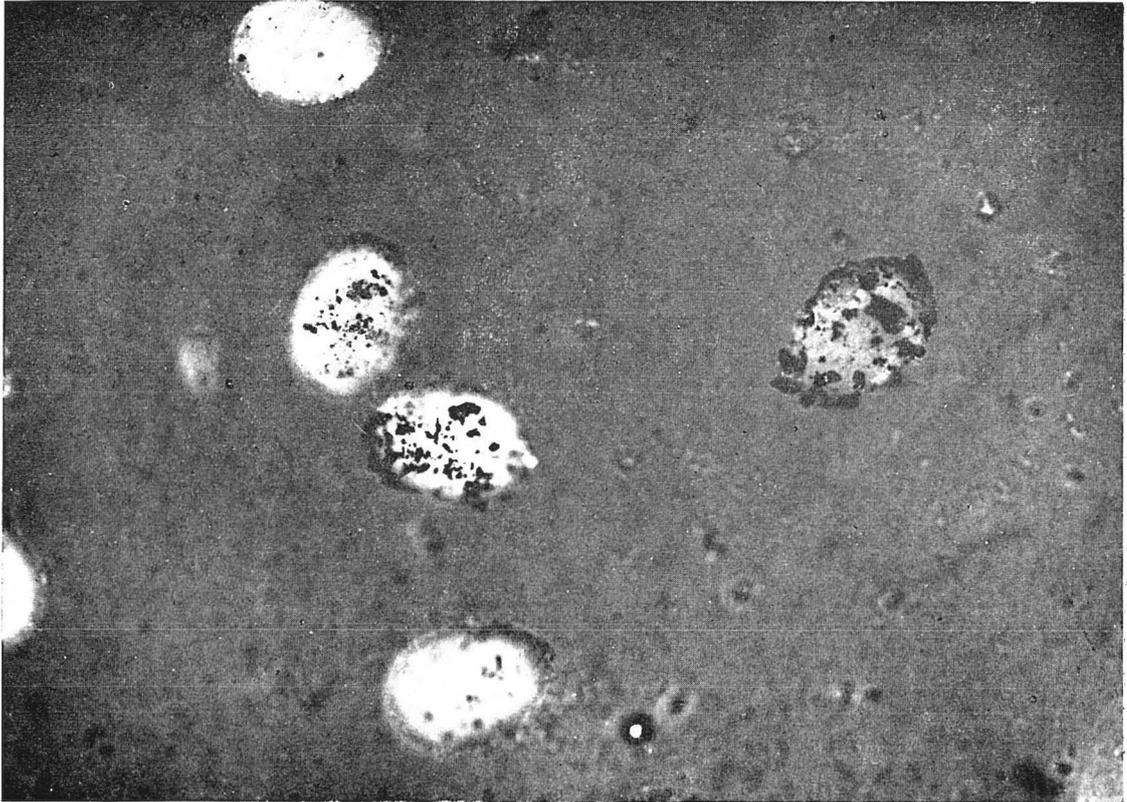


FIG. 2 : Eggs of *Arctoseius cetratus* camouflaged by the application of particles of the substrate.

#### EGGS :

The eggs were oval to round and distinctly pruinose due to a waxy, granular deposit easily removable by wetting with 70 % alcohol or by a camel-hair brush. The mean dimensions of 20 eggs mounted in Faure's medium was  $216 \times 178 \mu$  (range  $187 \times 146 \mu$  to  $259 \times 196 \mu$ ) with rounded eggs up to  $225 \times 213 \mu$ . The surface of the egg appeared smooth when viewed under a high power microscope ( $\times 1200$ ) with a reticular layer of fatty material just below the surface. Black particles were noticed on the surface of many eggs (Fig. 2) and observations on ovipositing females showed these to be a form of camouflage. Eggs were often deposited deep in crevices but sometimes on smooth parts of the substrate. Soon after an egg had been deposited the female "palpated" the uppermost surface of the egg while legs II performed simultaneous movements (at about 2/sec.) which lifted particles onto surfaces of the egg where they adhered. This continued for several minutes, a female often returning from a short distance to continue the process. The cover achieved was usually incomplete and some partially buried (and therefore well concealed eggs), were covered only on their accessible surfaces suggesting covering the eggs to be a normal process. However, such behaviour appears not to have been recorded in arctoseiines.

#### REARING :

Hatching tests using laid eggs over a 14 h period suggested that the bulk of eggs (28) hatched after 5-6 days at  $22^{\circ}\text{C}$  with single eggs hatching after 3, 4 and 7 days. The eggshells were split

roughly into two on hatching and were apparently not consumed by the larvae. Two groups of 15 eggs placed on watchglass over a saturated solution of potassium sulphate (R.H. 97 %) rapidly collapsed apparently by desiccation.

Mites were successfully reared from larvae in individual cells on a diet of sciarid eggs alone and required a minimum of *c* 7 days to become adult. Cast skins were sometimes found stretched on the substrate and were probably not consumed by the emergent mite. One group, consisting of three males and two females was maintained for 5 wk after reaching maturity. No eggs were laid by laboratory reared, unmated females held for 1 month.

Attempts to mass rear the mites in polyethylene pots proved unsuccessful. Although fed regularly, reproduction ceased and developmental stages rapidly disappeared and each pot finally contained only large numbers of highly active females. Locomotor excitation was also characteristic of females reared individually and suggested obligate phoresy. However, few attachments were induced by introducing such females to emerging sciarids (BINNS, 1973 (1)).

#### RÉSUMÉ

Ce texte traite de l'habitat et de la distribution d'*Arctoseius cetratus* et donne des précisions concernant l'alimentation et la phorésie. On y décrit l'élevage individuel de ces acariens et les cultures en masse avec des œufs de sciarides. Les femelles phorétiques étaient fécondes. L'oviposition commença 24 heures après la séparation et les Acariens produisirent 2,5 œufs par jour par la suite. Les Acariens nourris de nématodes pondirent moins d'œufs. Les femelles élevées seules ne produisirent pas d'œufs. La surface des œufs nouvellement pondus fut camouflée par une application de particules du substrat. Les larves apparurent au bout de 5 à 6 jours et devinrent mûres après une semaine environ.

#### SUMMARY

The habitat and distribution of *Arctoseius cetratus* are summarised and details of feeding habits and phoresy given. Rearing of individual mites fed on sciarid eggs and of mass cultures is described. Phoretic females were fertile. Oviposition began 24 hours after detachment and mites produced 2.5 eggs/day thereafter. Fewer eggs were laid by mites feeding on nematodes. Females reared in isolation produced no eggs. The surface of freshly laid eggs was camouflaged by the application of particles of the substratum. Larvae emerged within 5-6 days and matured after approx. 1 week.

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