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Tackling the lucerne flea and red-legged earth mite

by M. M. H. Wallace

Lucerne Flea

The lucerne flea, *Sminthurus viridis*, was first recorded in Australia at Morphettville in South Australia in 1884. Since that time it has spread over much of the agricultural land in southern Australia where it is regarded as a pest of improved pastures and legume crops such as lucerne. But a predator with a special liking for the pest is spreading also.

A predatory mite, *Bdellodes lapidaria* of European origin, was noticed feeding on *S. viridis* in pastures in Western Australia years ago. Subsequently, this mite played an important role in restricting the population increase of *S. viridis*. Surveys established that *B. lapidaria* unfortunately did not occur over the whole of the area infested by *S. viridis* in Western Australia. The flea penetrated further into dry regions, so that there remained a strip of country where infestations were unrestrained by *B. lapidaria*’s predation.

In 1962 an extensive survey of the whole of southern Australia yielded large numbers of predatory bdellid mites in addition to the introduced *B. lapidaria*. Entomologists collected representatives of five genera, all of which were known to occur in the Mediterranean regions of Europe and north Africa. One genus, *Bdella*, was represented by only one species in Australia but by at least 20 species in Europe. Another genus, *Molguus*, common in Europe and represented there by 11 species, was completely absent from Australia.

Research workers knew that Collembola (springtails such as lucerne flea) comprised the principal source of food for most bdellid mites. They postulated that amongst the many species of the two genera *Bdella* and *Molguus* in Europe, there might well be one or more species feeding on Collembola, possibly with a special liking for *S. viridis* in the pasture habitat. They planned a survey of western Europe and Morocco for 1964-65 to examine this hypothesis.

Altogether they collected 15 species of bdellid mites, but found only two commonly in pastures feeding on *S. viridis*. These were *Bdellodes lapidaria* (already in Australia) and *Neomolgus capillatus*. *N. capillatus* appeared to have a special affinity for *S. viridis*. The fact that it could tolerate the driest areas examined, near Almeria in Spain and near Chicaea in Morocco, where the annual rainfall was less than 180 mm, indicated that it should be capable of establishing throughout the full range of its prey in Australia.

The entomologists collected living *N. capillatus* in March 1969 at two sites, near Rabat in Morocco, and near Montpellier in France. In all, 11 shipments (14,000 mites) were sent from Morocco and five shipments (3,500 mites) from France. All were released at the Denmark Research Station in the far south-west of Western Australia, since that was the only site where green pastures were available so early in the season and where *S. viridis* was active.

In transit from overseas the mites laid an estimated 16,000 diapause (dormancy stage) eggs in their cages. The eggs were retained in the laboratory air-dry at 23°C, in the expectation that they would undergo some diapause development as do the eggs of *B. lapidaria* under similar conditions. That would prepare them for hatching at a later date. In July

[Image: Red-legged earth mites give this pea seedling little chance of survival.]

[Image: Lucerne fleas under attack from bdellid mites. Photo courtesy CSIRO.]

[Image: A lucerne flea damage to clover pastures.]

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1969 those eggs were placed out in a pasture near Waddi Forest, about 200 km north of Perth. In an area known to carry no *B. lapidaria*. Despite severe drought conditions in 1969, two mites were found subsequently at that site in September 1970. Larger numbers appeared in 1971 indicating a successful establishment. In view of this unexpected success it was not necessary to draw upon the populations of mites which had become established at Denmark.

Good rains and substantial pasture growth supporting a high population of *S. viridis* enabled *N. capillatus* to build up its numbers substantially in 1972 so entomologists re-collected more than 500 in October of that year and re-distributed them to another site near Ejanding. Similarly in August 1973 they collected a further 500 and transferred them to a third site near Yorkorraine.

They made counts of *S. viridis* in both the mite release area, and in a neighbouring control area, regularly throughout each season from 1963 to 1976, when they ceased because by then *N. capillatus* had spread into the control area.

During the ten year period from 1963 to 1972 the numbers of *S. viridis* in the two areas being sampled averaged 3,049 per square metre in the control area and 3,711 per square metre in the area selected for the release of the predatory mites. *N. capillatus* first became abundant in the spring of 1972 but that was too late to influence the numbers of *S. viridis*. From 1973 to 1976, when *N. capillatus* was active each year *S. viridis* numbers in the control area showed little change and averaged 3,175 per square metre, whereas in the release area numbers were reduced to only 730 per square metre or 22 per cent of those in the control area. Clearly the introduced mites were exerting a substantial control of *S. viridis* at that site.

Since 1976 only two spot checks have been carried out. A survey in October 1979 failed to reveal mites at any of the release sites, so it seemed that the poor seasons experienced in 1978 and 1979 may have taken a toll. However, a more recent survey in September 1980 showed that a very substantial population of *N. capillatus* had persisted at Waddi Forest and had continued to spread, although very slowly. Mites were found also at the Yorkorraine site, but in small numbers only.

Present indications are that *N. capillatus* is now strongly established and has survived several poor seasons. It is clearly capable of a substantial control of *S. viridis* in pastures but its rate of spread is extremely slow. It will be many years before research workers can determine its real success in the biological control of *S. viridis*.

**Red-legged earth mite**

The Red-legged earth mite, *Halodyeus destructor*, was first recorded in Australia in 1917 when it was discovered attacking potatoes and other vegetable crops near Bunbury, Western Australia. Since then it has spread rapidly over large areas in south western and south eastern Australia. There is little doubt that it was introduced accidentally from South Africa where it was first described in 1908.

A related mite, the blue oat mite, *Pentaleucus major* was first noted in Australia in 1921 attacking oats near Delgura, New South Wales. Subsequently it too spread rapidly and now occurs in all the areas occupied by *H. destructor*. It has also extended its range further inland and northwards and in eastern Australia reaches into south eastern Queensland. *P. major* probably originated in Europe, where it is common especially in Mediterranean regions.

The first report of predatory mites attacking these pest mites is that by Wilson in 1937 in the south of France. He described predation on *P. major* by an anystid mite then identified as *Anystis baccarum*. That mite occurred commonly in pastures and meadows. It was a general feeder attacking a variety of Collembola and Acari (mites). Research workers thought at the time that, if it were introduced into Australia, it might turn its attention to *H. destructor* as well as *P. major* and so exert some control of both pests. World War II intervened at that stage and the project was abandoned.

During an extensive survey of bdellid mites in southern Australia in 1962, entomologists collected large numbers of anystid mites. They belonged mainly to two genera, *Anystis* and *Walzia*. The dominant species was *Walzia australica* (Womersley), which was found usually outside the main agricultural areas and in natural bushland habitats. They concluded that *W. australica* was a native species and of little or no significance in the pasture habitat. Less abundant, but widely distributed in horticultural situations, was a species agreeing with the descriptions of *Anystis baccarum*. It was rarely found in pastures.

On the basis of this evidence it seemed possible that the species described by Wilson inhabiting pastures and meadows in France was not, in fact, the same species as that found in horticultural habitats in Australia.

An Australian team then surveyed western Europe and Morocco, and collected large numbers of anystid mites from over 400 sites. *A. baccarum* was found to occur widely throughout western Europe north of the Mediterranean influence, and as in Australia appeared to prefer horticultural habitats. It was rarely found in grazed pastures.

On the Mediterranean coasts of France the species found by Wilson was abundant and, as he noted, preying actively on *P. major*. They found it to be restricted to regions influenced by the Mediterranean climate. It was rarely found in habitats other than pastures or meadows. A detailed taxonomic study then showed that it was indeed a distinct, and apparently undescribed species, designated for convenience as *Anystis* sp. *A*. Australian research workers decided then to re-open the project begun by Wilson in 1937 and to experiment with the introduction of the species into Australia in the expectation that it would not only exert some control of *P. major* but might also turn its attention to *H. destructor*.

They noted that in the pastures in southern France the complex of pest species and predators already in Australia, *P. major, Smiththrus viridis, Bdelodes lapidaria* and
Neomolgus capillatus . . . all appeared to co-exist in a balanced situation with Anystis sp. A, so that no serious adverse effects were likely to result from the introduction of the latter species.

They collected live Anystis sp. A near Frejus in an abandoned pasture in May 1965, and sent more than 18,000 mites to Western Australia. Only 53 per cent survived, due largely to the aggressive cannibalism of the mites in the shipment cages. The mites were released at four sites, near Miling, York, Beverley and Pinjarra, where monitoring of populations of H. destructor, P. major and lucerne fleas had started in 1963.

The releases resulted in successful establishment at Miling and Pinjarra. By 1968 good numbers were present in the immediate vicinity of the release sites, at least in the spring. However, it was not until 1972 (Miling) and 1973 (Pinjarra) that good numbers appeared earlier in the season. In the meantime laboratory tests had shown that Anystis sp. A readily attacked H. destructor.

At Miling, in the eight years before 1971 there were more H. destructor (x 1.65) in the rather-better pasture of the introduction plot than in the neighbouring control plot. In the next five years 1971 to 1975 the situation was consistently reversed so that there were fewer H. destructor (x 0.60) in the introduction plot containing Anystis sp. A than in the neighbouring control plot. The maximum benefit was achieved in 1973 when the numbers in the introduction plot were only 30 per cent of those in the control plot.

There was a similar trend at the Pinjarra site where in the ten years before 1973 there were almost exactly equal numbers of H. destructor (x 1.04) on average in both the introduction plot and in the control plot. In the next four years 1973 to 1976 there were again consistently fewer H. destructor (x 0.76) in the introduction plot than in the neighbouring control plot. The maximum benefit was achieved in 1974 when the numbers in the introduction plot were only 20 per cent of those in the control plot.

Although numbers were lower throughout, changes in density of P. major followed a similar pattern. Further sampling was abandoned since by 1975 or 1976 the predatory mites had spread into the control plots and comparisons of prey numbers were no longer useful.

The roles of the predators

Clearly both predators, Neomolgus capillatus and Anystis sp. A, had an influence on the numbers of their respective prey in the experimental release sites. How great that influence will be on a field scale remains to be seen.

It is possible that relatively small reductions in abundance of lucerne flea and red-legged earth mite will be enough to render them unimportant to the farmer. If the predators can achieve that sort of reduction, as seems possible, then they will have made a very useful contribution to agriculture in southern Australia.

Neither of these predatory mites is capable of travelling long distances, so it obviously will be many years before they will colonise large tracts of country. As populations build up in more areas, further collecting and redistribution can be carried out to help speed up the colonising process.

Note: In recent years the Department of Agriculture has followed up the CSIRO introductions. Its entomologists have concentrated on extending the range of the red-legged earth mite predator Anystis, because since the 1960s, lucerne flea's importance as a pest in annual pastures has been steadily diminishing while red-legged earth mite has continued to be a problem.

During the past three years the Department has collected predators at Miling for distribution in the Esperance region, where RLEM is an extremely common pest in pastures. Unfortunately, Anystis does not appear to have become established at Esperance as no recoveries have been made in subsequent seasons.

Entomologists have planned numerous releases of Anystis throughout the wheatbelt for the 1981 season, since the natural rate of spread is very slow and artificial assistance is necessary.

They also have a project under way to examine the response of subterranean clover cultivars to RLEM. They hope to identify strains with natural resistance to mite attack, so that this resistance can be incorporated in the Department's sub clover breeding programmes. So far they have established that there is a wide range of susceptibility to mite attack in the seedling stage. Similarly, some cultivars are much less affected during flowering and seed production than others. This fact could account in part for the ability of some cultivars to persist in pastures.