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Capparis spinosa (Capparidaceae) : an oviposition substrate for *Lampides boeticus* LINNAEUS, in southern Spain (Lepidoptera : Lycaenidae) (*)

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Zusammenfassung

In Süd-Spanien, legt *L. boeticus* im Sommer seine Eier auf *C. spinosa* ab, da wo keine andere Futterpflanzen verfügbar sind. Trotz dem verbreiteten Kannibalismus unter den Raupen dieser Art, haben wir oft Eiablagen in den selben Knospen beobachtet, insbesondere auf Pflanzen in der Blütezeit. Eier wurden in Gruppen von ca. 3 auf den Knospen von *C. spinosa* gefunden. Obwohl die Zucht der Raupen in unserem Laboratorium nicht möglich war, können wir bestätigen, daß die frischgeschlüpften Raupen sich innerhalb der Knospen ernähren.

Summary

In southern Spain, during the summer, *Lampides boeticus* L. uses *Capparis spinosa* as oviposition substrate in areas where no other foodplants are available. Despite the cannibalism frequent in the larva of this species, high egg-loads were observed, especially on plants in full bloom. Eggs were found on average in clusters of around 3 per bud. Although it has not been possible to observe full development of larvae on this plant in the laboratory, we have confirmed that freshly hatched larvae make a hole in the sepals, and feed subsequently inside the bud.

Lampides boeticus (LINNAEUS, 1767) is a widespread species in tropical and temperate zones all over the world, excluding North America. In southern Spain, it is multivoltine, with 4 or 5 generations per year, from April to October. This species lives in very different habitats, including towns (MARTIN, 1984), where it can even feed on fruits of *Robinia pseudoacacia.* Therefore, it presents great ecological plasticity, no doubt enhanced by its migratory habits (NEL, 1984 ; ROBERT *et al.*, 1983), which give it a great capacity for colonising new habitats. However, the key factor in its adaptation to new habitats is undoubtedly its polyphagous feeding habits, its capacity to feed on a wide range of foodplants.

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Around 100 species of Leguminosae are reported for *L. boeticus*, belonging to 40 different genera (JORDANO *et al.*, in press). Few references are available concerning plants of other families. These are *Rosmarinus* sp. (Labiatae) in Spain, *Cliffortia* sp. (Rosaceae) in South Africa, and *Passiflora foetida* (Passifloraceae) in Sumatra (RIBBE, 1909 ; DICKSON, 1953 and DEN DOOP, 1918 in MARTIN, 1984). It should however be mentioned that the range of foodplants used by individual populations is frequently small. In the case of multivoltine species like this, there is often a temporal alternation. For example, in south-eastern France, *L. boeticus* lays its eggs on *Ulex* sp. between January and April, on *Colutea* sp. in May, and during the summer on *Spartium junceum* (NEL, 1984). In Spain, observed preferences for *L. boeticus* are : *Pisum sativum, Colutea atlantica* and *Spartium junceum* (MANLEY & ALLCARD, 1970 ; GOMEZ BUSTILLO & FERNANDEZ RUBIO, 1974 ; MARTIN, 1984).

Larvae of this species need to ingest food which is particularly rich in protein, thus giving rise to the use of plants and parts of plants with a high nitrogen content, such as the reproductive structures (flowers and fruits). This explains the anthophagous and carpophagous habit of the larvae. This pattern is widely found in the Lycaenidae, and has been related to myrmecophily (PIERCE, 1985), a mutualistic relationship which requires a considerable energu investment for the synthesis of amino-acids and sugars, which constitute the reward offered to the ants.

In southern Spain, the availability of flowers and fruits on which the larvae depend is limited by the marked seasonality of the climate, which influences the phenology of foodplants. This problem is solved in some areas by *L. boeticus* exploiting alfalfa crops (*Medicago sativa*) on irrigated land (MARTIN, 1984 ; pers. obs.), an alternative which ensures the maintenance of a population of relatively high density (JORDANO, 1980). However, this alternative is virtually non-existent in southern Spain, where irrigated land accounts for only a small proportion of cultivated areas, and where alfalfa is a minor crop.

During our research on the biology and ecology of *Colotis evagore* KLUG (Pieridae) in the Guadalquivir river valley, we have frequently observed, over the last three summers, a northward movement of *L. boeticus* across this area. At this time of year, herbaceous plants on the embankments and uncultivated marginal areas dry up. *Capparis spinosa*, the foodplant of *C. evagore*, (also used in summer by two other Pieridae (*Artogeia rapae* L. and *Pieris brassicae* L.), is an exception, since it puts out new shoots annually from large roots, which actually enables it to grow and bloom in summer (FERNANDEZ HAEGER *et. al.*, 1987).

In summer 1984, we frequently observed *L. boeticus* on the leaves of this plant, a fact which we considered unimportant, due to the taxonomic position of *C. spinosa*, at some distance from the Leguminosae and closer to the Cruciferae, with which it shares the presence of glucosinolates, and in particular glucocaparin, identified as methyl-isothiocyanate (KJAER, 1960). These allelochemicals are deterrent to most herbivores.

In summer 1985, a more detailed observation of *L. boeticus* revealed that their presence on such plants was not accidental, and that the plant attracted the butterflies, as shown by the constancy and frequency of their visits. We were able to confirm that on most occasions, they were females, whose behaviour were characteristic of the foodplant identification phase. Females moved across the leaves curling the abdomen and crawling the ovipositor over the leaf surface. When they stopped, they rubbed the upper surface of the leaf with the foretarsi, touching it with the tips of the antennae.

We were finally able to confirm the laying of several eggs, scattered over the upper surface of some leaves. This occurred in July in an area near Castro del Rio (province of Córdoba), and was initially interpreted as an oviposition mistake (DETHIER, 1959 ; STRAATMAN, 1962 ; RODMAN & CHEW, 1980), which was somewhat unexpected in view of the nature of the plant, and the fact that wild *Medicago sativa* plants, with ripening fruits and still some inflorescences, were growing in a ditch only a few meters away. These plants, where several *Polyommatus icarus* females were found to be laying, were apparently ignored by *L. boeticus*.

In the summer of 1986 we were able to confirm conclusively that the oviposition observed in the previous year was not an isolated case. This was borne out by the observation of many females laying on unopened *C. spinosa* flowers in September near Moriles (Province of Córdoba). A close study of the plants revealed several *L. boeticus* eggs, some of which had hatched. An average of 3.35 ± 1.99 eggs ($n = 23$) were found per bud, and 82.6% of the buds contained clusters of two or more eggs (Fig. 1), despite the cannibalism common in the caterpillars of this species (MARTIN, 1984 ; pers. obs.). The preference for unopened flowers as an oviposition substrate agrees with the results obtained by MARTIN (1984), who found 84.4% of eggs laid on flowers and only 10.6% on leaves.

These observations may also explain the laying preference observed in another area in September 1986, where eggs were found on burnt and re-sprouted plants, in full bloom at that time, rather than on plants which had not been burnt, that were phenologically more advanced and had almost finished flowering. The *C. spinosa* in this area covers the verge of a road, forming a straggling hedge about 400 metres long. It is sometimes partially

Fig. 1. Number of eggs of *L. boeticus* on buds of *C. spinosa.*

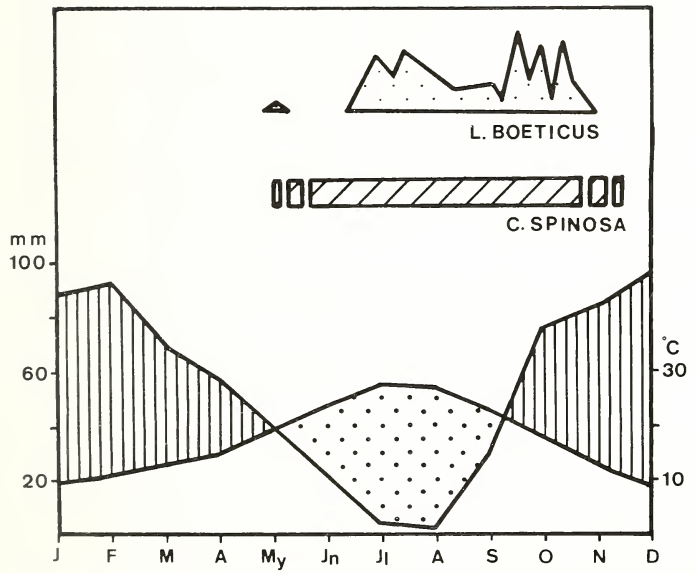

Fig. 2. Ombrothermic diagram of the city of Córdoba : The phenology of *C. spinosa* and abundance of *L. boeticus.* The vegetative growth period of the plant (inset) coincides with hot, dry weather ; this period also coincides with the period when *L. boeticus* numbers are highest (inset, top).

burnt. Burnt plants tend to put out new shoots around 20 days later, and bloom again in profusion.

This may also explain the laying of eggs on leaves, seen in the first area mentioned above in 1985, where buds were scarce, because of mass picking for commercial purposes.

The phenology of the plant is also observed to coincide with the periods of greatest abundance of *L. boeticus* (summer and autumn generations), when numbers are swelled by migrating individuals (Fig. 2).

To chart the development of the larvae, bud samples were collected and observed in the laboratory, where caterpillars hatched normally. After making a hole in the sepals, they entered the bud and fed mainly on the anthers. Limited availability of buds, together with their rapid deterioration after cutting, led to the failure of the rearing experiment. Despite this, several caterpillars continued to develop up to the third instar. In this connection, it should be pointed out that *Pontia daplidice* L. females were occasionally seen to lay on the leaves of this plant. Nevertheless, and despite its biochemical relationships with the Cruciferae and Resedaceae, usually used for oviposition by *P. daplidice*, the newly hatched caterpillars of this species rejected it completely, finally dying of starvation.

Thus, though it has not been possible to study the full larval development on this plant, it seems likely that, under natural conditions, this species may be able to complete its life cycle on it.

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Corrigendum

The editor would like to apologize for an unfortunate error in the list of contents of *Nota lepid.* 10 (3) : 137. For *Noctua warrensis* sp.n., read *Noctua warreni* sp.n.