

On the larval host plants of *Papilio alexanor* ESPER, 1777 in southern Greece (Lepidoptera: Papilionidae)

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Abstract. On the Peloponnese Peninsula in southern Greece egg-laying behaviour of *Papilio alexanor* ESPER, 1777 could be observed in early April 2022 in a coastal area near Trahila (about 50 km south of Kalamata). The habitat consisted of sun-exposed rocky hillsides with Mediterranean phrygana and maquis scrubland in altitudes between 100 m and 350 m. Eggs were laid on flowering specimens of *Ferula glauca* (Apiaceae), a close relative of *Ferula communis* (Apiaceae). After the initial observations were made, many eggs could be easily found in those inflorescences that had a specific developmental stage, i.e., shortly before blooming. The findings are discussed with regard to other available data on host plants of *P. alexanor* in the Eastern Mediterranean region showing the additional use of *Opopanax* and *Scaligera* species in that area.

Keywords. Palearctic Region, Peloponnese, host plants, *Ferula glauca*, Apiaceae, *Papilio alexanor*, Papilionidae, Lepidoptera

Zusammenfassung. Das Eiablageverhalten von *Papilio alexanor* ESPER, 1777 konnte auf dem Peloponnes im Süden Griechenlands Anfang April 2022 an einem Küstenabschnitt nahe Trahila (ca. 50 km südlich von Kalamata) beobachtet werden. Das Habitat bestand aus sonnenexponierten Felshängen bewachsen mit mediterranem Buschland (Phrygana und Macchia) in Höhenlagen zwischen 100 m und 350 m. Die Eier wurden an blühreifen Pflanzen von *Ferula glauca* (Apiaceae) abgelegt, einer nahen Verwandten von *Ferula communis* (Apiaceae). Nachdem die ersten Beobachtungen erfolgt waren, konnten viele weitere Eier relativ leicht in denjenigen Blütenständen gefunden werden, die ein bestimmtes Entwicklungsstadium aufwiesen, und zwar kurz vor dem Aufblühen. Die Ergebnisse werden im Hinblick auf andere verfügbare Daten über die Wirtspflanzen von *P. alexanor* im östlichen Mittelmeergebiet diskutiert, welche die zusätzliche Nutzung von *Opopanax*- und *Scaligera*-Arten in dieser Region aufzeigen.

TION.ORG 2025), as the current status in that region has remained puzzling (e.g. BOLLINO & SALA 2004, BONELLI et al. 2015).

A large number of subspecies have been described from the disjunct populations in Europe and the Middle East, with many of them now considered synonyms. Already SEITZ (1932) stated: “Especially in *P. alexanor* it is extremely difficult to discern geographical forms with constant features, as phenotypes differ strongly according to climatic conditions, which can be very different in various years”. Therefore, the number of subspecies is still controversial in this species, with modern monographs recognizing four (TSHIKOLOVETS 2011, NAZARI et al. 2023) to nine (BOLLINO & SALA 2004) subspecies. A recent phylogenetic analysis by NAZARI et al. (2025), however, supported five genetic entities across the species’ range, which, in Europe and the Middle East, refer to ssp. *alexanor* ESPER, 1777 (South-east France and northern Italy), ssp. *magna* SCHULTZ, 1906 (Balkan Peninsula) and ssp. *orientalis*, ROMANOFF 1884 (Turkey, Israel, Iran and Armenia).

Host plant usage of *P. alexanor* varies according to geographic region, but is restricted to the plant family Apiaceae. In the southern Alps of France and Italy *Ptychotis saxifraga* (Apiaceae) plays clearly the dominant role (e.g. DAVID & SANETRA 1994, BONELLI et al. 2015, ANSELMO 2021) as in a population recently introduced to Switzerland (GERBER 2015). In the past, *P. saxifraga* was apparently often confused by many authors with *Seseli montanum* (Apiaceae) and *Trinia glauca* (Apiaceae) (e.g. DAVID & SANETRA 1994, BARUZI & CAIMI 2021). A second host plant alternatively used in certain parts of France and Italy is *Opopanax chironium* (Apiaceae) (e.g. RECHE 1978, BOLLINO & SALA 2004). Most findings of larvae on this plant species are assignable to more southerly areas like Alpes-Maritimes, but some records far from the coast also do exist (RENNWALD 2021).

Introduction

The southern swallowtail (*Papilio alexanor* ESPER, 1777) is an iconic and endangered butterfly that has attracted the attention of entomologists for a long time (e.g., SEITZ 1932, KÖSTLER 1991, BOLLINO & SALA 2004, NAZARI et al. 2025). Phylogenetically, *P. alexanor* occupies a unique position among its congeners in that it constitutes the oldest monotypic lineage within the genus *Papilio*, whose most recent common ancestor presumably lived during the Oligocene in the eastern Palearctic region (CONDAMINE et al. 2023). Its present-day distribution ranges from Tajikistan through the Near East to the Mediterranean zone of southern Europe,

where disjunct populations occur in southeastern France, Italy and the Balkans (DE FREINA 1983, BOLLINO & SALA 2004, TSHIKOLOVETS 2011). In the last decade *P. alexanor* has been rediscovered in Croatia, Bosnia & Herzegovina and Serbia at several locations (VEROVNIK & SVARA 2016, RUSSELL & PATEMAN 2018, KOREN & MARTINOVIĆ 2019, VUKAJLOVIĆ et al. 2025), while records of this species from Greece are plentiful (e.g., FUCHS 1992, LEPIFORUM.ORG 2025, OBSERVATION.ORG 2025). Interestingly enough, some new sightings of *P. alexanor* in southern Italy have emerged quite recently (iNATURALIST.ORG 2025, OBSERVA-



Fig. 1. Imago of *Papilio alexanor* ESPER, 1777 on a flowering thistle, approx. 10 km northeast of Kalamata, 2.V.2005 (Photo: C. ZELLER).



Fig. 2. Habitat of *P. alexanor* ESPER, 1777 with nectar plants such as thistles (foreground) and flowering *Euphorbia dendroides* (background), above Tahira, Peloponnese, 8.IV.2022 (Photo: M. SANETRA).

On the Balkan Peninsula the situation concerning larval food sources is more complex. *Opopanax chironium* is recorded from Croatia, Bosnia & Herzegovina and Greece (BOLLINO & SALA 2004, VEROVNIK & SVARA 2016, KOREN & MATINOVIĆ 2019) and *Opopanax hispidus* (Apiaceae) from Peloponnese and Samos (KÖSTLER 1991, BOLLINO & SALA 2004, PYRGUS.DE 2025). BOLLINO & SALA (2004) also record *Ferulago* sp. (Apiaceae) for central Greece. While the abovementioned plant species are tall and have large yellow inflorescences, there is also a small, white umbellifer used by *P. alexanor* in Greece (similar to *P. saxifraga* in central Europe), which is *Scaligeria napiformis* (Apiaceae) (LEPIFORUM.ORG 2025). This species, nominally recorded as host plant of *P. alexanor* quite late (SCHÖN 2007), was up to that time most likely confused with *S. montanum* and *Pimpinella* sp. (Apiaceae) (see also BOLLINO & SALA 2004 on identification errors regarding the latter two plants in central Greece).

In the following report, observations of eggs of *P. alexanor* on *Ferula glauca* (Apiaceae) are presented. Since observations were made in very early spring (beginning of April), these shed new light upon host plant usage of the species on the Peloponnese Peninsula in southern Greece on a seasonal scale.

Study Area

Observations were made in a Mediterranean coastal area on the Peloponnese near Trahila about 50 km south of Kalamata. Geographical coordinates (roughly in the centre of the study area) are: N 36.782052, E 22.318821. The location was situated at altitudes between 100 m and 350 m near the western coastline of the northern Mani Peninsula, which is the southern extension of the Taygetus mountain range.

Butterfly and egg observations

Some swallowtail butterflies were noticed on a hiking tour on the Mani Peninsula on 8.IV.2022, as the path climbed upwards from sea level to about 100–200 m. At first these were thought to be *Papilio machaon* LINNAEUS, 1758, but the number of individuals seemed unusually high, since the butterflies were constantly crossing the path in restless flight. Obviously, most of them were males seeking for females. In total a number of 10–15 individuals were observed. Later, one *Papilio*-butterfly was

seen taking nectar from a flowering bush of pink thistles (Figs 1, 2), which immediately allowed identification as *P. alexanor*. The flight period of this species in Greece and Turkey has rarely been recorded to start in early April (except for early males), even in coastal areas (e.g. HESSELBARTH et al. 1995, BOLLINO & SALA 2004).

As observations went on, an egg-laying female was noticed on a tall herbaceous yellow-flowering umbelifer (Fig. 4). The inflorescences were then inspected and the typical green egg of *P. alexanor* was found within the flower buds of the umbels (Fig. 3). After these initial observations were made, several more eggs (around ten) could be easily found in those inflorescences that had a specific developmental stage, i.e., shortly before blooming.

Habitat structure

On Mani Peninsula near Trahila, *P. alexanor* inhabits sun-exposed, dry and rocky slopes with shrubland and scattered bushes (Fig. 4). This kind of habitat was combined with patches of flowery grassland (Fig. 2), herbs and nearby open ground with stones and gravel. Vegetation consisted of Mediterranean phrygana and maquis scrubland with typical plants like *Phlomis* spp., *Cistus* spp., *Myrtus* sp., *Pistacia* sp. and very characteristic shrubs or small trees of *Euphorbia dendroides* (Euphorbiaceae). In some habitat patches above 200 m open woodland with scattered olive and oak trees also occurred.

Larval host plant

Plants of the family Apiaceae, on which the eggs of *P. alexanor* were found (Figs 3, 4), could be identified without difficulty as belonging to the genus *Ferula*. However, the basal leaves (Fig. 5) appeared quite different from *Ferula communis*, which is the host-plant of *Papilio hospiton* GENÉ, 1839 on Sardinia and well known to the author. Further enquiry (MITTELMEER-FLORA.DE 2025, IDENTIFY.PLANTNET.ORG 2025) led to the taxon *Ferula glauca*, a perennial herb growing up to 100–300 cm. Although *F. communis* and *F. glauca* were formerly considered subspecies (TUTIN et al. 1968, ROTTENSTEINER 2014, VANGJELI 2015, DIMOPOULOS et al. 2016), they are nowadays usually distinguished as two species (HAND 2011, HASSLER 2025, HAND et al. 2025, POWO 2025). Reclassification is based upon differences in morphology,



Fig. 3. Egg of *P. alexanor* ESPER, 1777 (arrow) in an inflorescence of *Ferula glauca*, Tahira, Peloponnese, 8.IV.2022 (Photo: M. SANETRA).



Fig. 4. Coastal habitat of *P. alexanor* ESPER, 1777 with two flowering host plants (*Ferula glauca*), Tahira, Peloponnese, 8.IV.2022 (Photo: M. SANETRA).



Fig. 5. Basal leaves of *Ferula glauca*, near Lagkada, Peloponnese, 15.IV.2022. (Photo: M. SANETRA).

anatomy, and volatile chemical profiles, which can serve as reliable markers for separating them (MAGGI et al. 2009). Another argument for species rank is their regional co-existence with different ecology and habitat preferences, for instance along the Italian Adriatic coast (BIONDI et al. 2012). While *F. glauca* prefers rocky or scree areas, *F. communis* is a nitrophilous species, which frequently grows in ruderal places, agricultural land and along road edges.

Discussion

Ferula glauca is documented here as host plant for *P. alexanor* on the Peloponnese Peninsula in southern Greece. It appears that many previous records of *Ferula* in that area were due to misidentifications (WEIDEMANN 1986, LEESTMANS & ARHEILGER 1987, KÖSTLER 1991), so that the use of that plant genus in Greece has been questioned in general (BOLLINO & SALA 1995, 2004). Nevertheless, there are reliable records of *P. alexanor*-larvae feeding on *Ferula* from western Turkey (BOLLINO & SALA 1995 referring to K. ROSE in litt., HESSELBARTH et al. 1995) and from the eastern part of the range (DE FREINA 1983, BOLLINO & SALA 2004, ZARIKIAN & BENYAMINI 2019). However, taking all available information together it seems likely that one of the most important larval host plants of *P. alexanor* in Greece is *Opopanax hispidus* (FUCHS 1992, BOLLINO & SALA 1995, 2004, LEPIDFORUM.ORG 2025). On the island of Samos, *O. hispidus* also serves as the dominant food plant (KÖSTLER 1991, BOLLINO & SALA 1995, PYRGUS.DE 2025), albeit described as *Pastinaca sativa* (Api-

aceae) in the original report by SCHMITT (1989). Additionally, larvae of *P. alexanor* have been reported to feed on *Scaligera napiformis* (a rather small plant with white flowers) on the Peloponnese near Platsa (LANGER 2018), a location very close to the study area (about five kilometres).

On the Peloponnese, as far as yet known, we have three different host plants, namely *F. glauca*, *O. hispidus* and *S. napiformis* available for *P. alexanor*. Different blossom periods make the successive use of several host plants advantageous, because eggs are laid on the flower buds just before blooming (pre-bloom buds). This behaviour ensures that the growing caterpillars have access to the nutrient-rich seeds as food (KÖSTLER 1991). The earliest fraction of *alexanor*-caterpillars on the Peloponnese feeds on *Ferula* from mid-April onwards, when no other host plant is flowering. Plants of the genus *Scaligera* will next be available for the emerging females of *P. alexanor* in May. Egg-laying was observed on *S. napiformis* on Peloponnese from mid-May to early June (Kardamili, 160 m, 16.V., PAPÉ 2012; Kalavrita, 800 m, 1.VI., ZIEGLER 2009). Furthermore, young caterpillars (L2-L3) were found near Platsa (Peloponnese, 100 m) on *Scaligera* on 10.V. (LANGER 2018). Since this location is almost identical to the study area, it becomes obvious that the seasonal use of *Scaligera* must be a few weeks later than that of *Ferula*. Records of caterpillars on *Opopanax* spp. are probably even later in the year, ranging from May to June on Samos (PYRGUS.DE) and the Peloponnese (KÖSTLER 1991). Congruent with this picture is the observation by BOLLINO & SALA

(1995), who report caterpillars of *P. alexanor* at Mystras (Peloponnese, 500 m) feeding on *Pimpinella* sp. (which most probably was *S. napiformis*) in early May and on *O. hispidus* in June. These authors (BOLLINO & SALA 2004) further concluded that “the use of different food plants with echeloned blooming represents a very important adaptation for a species with prolonged emergence period, offering same opportunities of reproductive success both to early and late emerged specimens”.

The first record of host plant usage with successive blooming periods in *P. alexanor* was by NAKAMURA & AE (1977) for populations from Israel involving *Ferula tingitana* (Apiaceae) (early season in May) and *Hepptaptera anisoptera* (Apiaceae) (later season May/June). Another interesting adaptation of *P. alexanor*, here to arid environments, is a long-term pupal diapause for up to five years in Israel and seven years in Armenia (ZARIKIAN & BENYAMINI 2019). In Israel larval host plants bloom only in years with sufficient rain, so that it is likely that the species’ diapause has become connected to the irregular blooming cycle of the plants. Thus, *P. alexanor* has co-evolved in many respects with its host plants across its vast distributional range.

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