First Record of the Lime Butterfly *Papilio demoleus* (Linnaeus, 1758) (Lepidoptera: Papilionidae) from Jordan

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Received: May 20, 2024; Revised: June 1, 2024; Accepted: June 8, 2024

Abstract: The lime butterfly *Papilio demoleus* (Linnaeus, 1758) (Lepidoptera: Papilionidae) is recorded from Jordan for the first time based on the identification of three specimens collected from Al Kurayyimah in the Jordan Valley during May 2024. Its biology, ecology, and distribution are briefly discussed.

Key words: Papilionidae, *Papilio demoleus*, lime swallowtail, invasive species, Jordan, Citrus.

Introduction

Five species of Papilionidae are known to occur in Jordan: Papilio machaon syriacus (Verity, 1908), Papilio alexanor maccabaeus (Staudinger, 1892), Allancastria deyrollei eisneri (Bernardi, 1971) Archon apollinus (Herbst, 1789), and *Papilio* saharae (Oberthür, 1879). (Larsen and Nakamura, 1983; Katbeh-Bader et al., 1998; Katbeh Bader et al., 2004). However, the lime butterfly, Papilio demoleus (Linnaeus, 1758), has never been recorded in Jordan before. Papilio demoleus has many common names: citrus dog, lemon butterfly, lemon caterpillar, lime butterfly, lime swallowtail, and orange butterfly. This butterfly is distributed in tropical and subtropical regions of southern Asia, ranging from Turkey, Syria, Lebanon, Iraq, Saudi Arabia, Iran and the Middle East to India, Nepal, southern China, Taiwan, and Japan. It is also found in Malaysia, Indonesia, New Guinea, and Australia. Also, it has been recorded in the Dominican Republic, Cuba, Puerto Rico, and Jamaica (CABI Compendium, 2021; Basbay et. al. 2020, Guerrero et al., 2004; Homziak and Homziak, 2006; Larsen, 1977 and 1984; John et al., 2021; Morgun and Wiemers, 2012; *Corresponding author: ahmadk@ju.edu.jo

Koçak et al., 2006; Peggie et al., 2022). Several subspecies are known of this species: Papilio demoleus demoleus (Linnaeus, 1758) is known in the Middle East, southern Asia and China, P. d. malayanus (Wallace, 1865), in South-East Asia, P. d. novoguineensis (Rothschild, 1908) in New Guinea, P. d. libanius (Fruhstorfer, 1908) in Taiwan, and P. d. sthenelus (Macleay, 1826) in Australia. A similar species, Papilio demodocus (Esper, 1798), is found in the Afrotropical region (including southern Oman, Yemen, and southwestern Saudi Arabia (Pittaway, 1985). Benyamini et al. (2007) confirmed the records of Papilio demoleus (Linnaeus, 1758) in Syria and discussed its appearance in Turkey and the Dominican Republic. After it was first recorded from Palmyra in 2003-2006, the lime butterfly was found in Aleppo in 2020. Its appearance maybe associated with abandoned agricultural areas due to the war or to climate change which may be considered as an indicator of climate change during last two decades in Syria (Zarikian, 2020).

Papilio demoleus attacks cultivated Citrus spp. in rural or urban areas but avoids dense, damp forests, and very wet areas. P. demoleus larvae feed on at least nineteen citrus species and varieties (Yunus and Munir, 1972). Feeding on the leguminous genus, Psoralea appears to be confined to the Australasian subspecies (Common and Waterhouse, 1981), but the Babchi, Psoralea corvlifolia was found as a host in India (Pandey and Bogawat, 1969). Other hosts recorded from India were the Custard Apple, Annona squamosa and the Champak, Michelia champaca (Patil and Rajashekhargouda, 1985). Riaz et al. (2020) reviewed the morphology, life cycle and management of two invasive subspecies of P. demoleus including P. d. demoleus. Radke and Kandalkar (1988) found that the female laid fifteen to twenty-two eggs, but Farid (1987) recorded a maximum of 511 eggs per female. The natural lifespan of wild adults rarely exceeds six days (Singh and Gangwar, 1989). Badawi (1981) studied some aspects of its biology and ecology in Saudi Arabia. The objective of this article is to record the presence of *P. demoleus* in Jordan for the first time and to alert citrus farmers in Jordan and plant protection specialists to the presence of this invasive pest.

Materials and Methods

Three specimens were collected by Dania Ashowbaky from a home garden with citrus trees in Al Kurayyimah, Jordan Valley (32°16'35.00" N 35°35'57.77" E), 153 m below sea level, in May 2024. Another specimen was seen on the 3rd of June 2024 under an orange tree at the same location. The specimens were deposited at the University of Jordan Insect Museum.

Results and Discussion

The three specimens were identified as *Papilio demoleus* (Linnaeus, 1758) (Figure 1). It appears to be as a natural range expansion of the Syrian populations of this species. The subspecies is most probably *P. d. demoleus* since the Syrian populations have been recently identified as *P. d.*

demoleus based on a molecular study (John et al., 2021). It is probable that P. demoleus has been introduced accidentally to new areas with citrus stock as egg, larvae, or pupae. Its spread may be promoted by new citrus plantations in agricultural or urban areas. It is possible that this butterfly has been in Jordan for several years but was not detected by farmers or non-specialists because it was thought to be one of other known papilionids such as Papilio machaon Linnaeus. This species is expected to expand its range in Jordan southwards, following citrus plantations along the Jordan Valley and may reach at a certain time to Aqaba at the southern tip of Jordan. Furthermore, it may expand its range into Palestine and Egypt and even other citrus cultivation areas in the southern Mediterranean countries. Peggie et al. (2022) showed that the average

duration of eggs was 3.7 days on *Citrus* spp., the duration of larvae lasts from thirteen to nineteen days, prepupal duration for one day, pupal duration lasts from nine to fourteen days and the total duration of the immature stages was between twenty-six and thirtyeight days. Adults live up to nineteen days in captivity. Therefore, the butterfly is expected to develop several generations in a year in Jordan. Its development may be arrested in the months of extreme hot summer months in the Jordan Valley, but it is expected to breed continuously in other seasons of the year.

It may attack citrus trees in home gardens in



Figure 1. Papilio demoleus Linnaeus, 1758 dorsal (left) and ventral (right) views.

the high lands.

Synthetic pyrethroids such as deltamethrin are highly effective for the control of P. demoleus larvae, however, integrated pest management using as biocontrol agents, microbial pesticides and phytopesticides, with synthetic pesticides should also be implemented (Riaz et al., 2020). A survey should be carried out to determine the current distribution of this insect and to evaluate the damage caused by its larvae to citrus orchards. In addition, natural enemies, and alternative hosts other than citrus should be investigated. Citrus farmers and plant protectionists in Jordan should be alerted to the presence of this invasive butterfly in Jordan.

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