
ON THE INTRODUCTION OF *PARANTHRENE TABANIFORMIS* (ROTTEMBERG, 1775) IN MALTA (INSECTA: LEPIDOPTERA: SESIIDAE)

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ABSTRACT

The introduction of *Paranthrene tabaniformis* (Rottemburg) in the Maltese Islands, an insect that is mainly associated with poplar trees (*Populus* sp.), is documented. Brief information is provided on the moth family Sesiidae with particular reference to the biology of *P. tabaniformis*. A brief overview of Maltese Sesiidae is included; previous records of *Bembecia scopigera* (Scopoli) were found to be incorrect as this material is *B. albanensis tunetana* (Le Cerf).

INTRODUCTION

A very important valley system in the Maltese Islands is that of Wied il-Qlejgħa (popularly known as Chadwick Lakes) which is connected to Fiddien and Ta' L-Isperanza Valley. This important valley complex receives an abundant supply of freshwater during the wet season and consequently the area supports a large variety of plants and animals associated with freshwater and moist habitats, which are otherwise rare in the Maltese Islands. In 1997, the then Ministry for Agriculture and Fisheries embarked on an ambitious project entitled "Rehabilitation of Wied il-Qlejgħa Valley". The project was funded by the Fourth Italian Financial Protocol. The main objectives of the entire project were (i) to increase the potential re-charging of the underground water table by encouraging water penetration into the ground, reduction of water losses and maximisation of the water-holding capacity of existing dams; (ii) the conservation and production-restoration of the agricultural land alongside the watercourse by ensuring availability of water for irrigation, reduction of agricultural soil losses and the reconstruction of structural retaining walls which had collapsed due to instability effects; (iii) the rehabilitation of the valley ecosystem, giving attention to the ecological characteristics of the valley system and (iv) the enhancement of the tourist and recreational potentials of the valley in harmony with its unique natural characteristics.

In December 2002, some Mediterranean trees and shrubs (namely *Ceratonia siliqua*, *Populus alba*, *Myrtus communis*, *Teucrium fruticans* and *Vitex agnus-castus*) were donated by an institution in Southern Italy to the Government of Malta for the embellishment of the Fiddien area as part of the rehabilitation project of Wied il-Qlejgħa. Following the interception of some immature insects on parts of this consignment (by the first two authors), the mentioned plants were put under quarantine. On the 25th of February 2003 the plants (still under quarantine) were inspected again, and gall-like protrusions were observed along some branches of *Populus alba* trees. Careful dissection of these branches revealed the presence of a lepidopterous caterpillar (Fig. 1) that was actively feeding in the tender branches and main stems of young *Populus* trees.

MATERIAL AND METHODS

Branches and main stems of the mentioned *Populus* trees, which were suspected to host this lepidopterous larva, were taken to the laboratory. Careful dissection of these infected branches was undertaken to search for the presence of larvae and pupae. Other new and healthy branches of *Populus* were cut, and small holes were drilled in these branches into which the live caterpillars, which had been previously found, were introduced to complete their development. These new branches hosting the caterpillars were enclosed in plastic containers (with fine net mesh tops) for the possible emergence of the adult moth so as to allow species identification. Material has been conserved in the private collections of the authors. The entire consignment of the imported *Populus alba* trees was destroyed by fire.

RESULTS AND DISCUSSION

Two adult moths emerged and these were identified as *Paranthrene tabaniformis* (Rottemburg, 1775) (Fig. 2) known by

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the common English name of Dusky Clearwing. The Maltese name of 'Bahrija Zunzan tal-Luq' is here proposed.

Material examined: Malta: Marsa, Ghammieri, 25.ii.2003, 8 mature larvae and one pupa (in branches of imported trees of *Populus alba*) from which 2 adult moths emerged between the 20.iv. and 27.iv.2003, leg. C. Farrugia and D. Mifsud.

Family Sesiidae: *Paranthrene tabaniformis* belongs to the moth family Sesiidae commonly referred to as clearwing moths. They are represented world wide by about 1,200 described species, of which about a hundred are present in Europe. Four species are known to occur locally and Table 1 provides host plant and distributional data (after Laštůvka & Laštůvka, 2001) of these species.

Clearwing moths exhibit Batesian mimicry, reflected not only in their characteristic morphology but also in their behaviour such as flight and other movements. They mimic a number of species of the order Hymenoptera (e.g. wasps, bees and sawflies), and often the precise taxon mimicked can be immediately recognised. European sesiid moths are diurnal; they fly during the day and are very active in the sunshine. Most species are oligophagous, that is, they are able to complete their development on related species of host plants. Strict monophagy (development on just one host plant) or polyphagy (development on unrelated host plants) is rare. Females of most species lay between 100-150 eggs on stems, leaves or new shoots. In general, species of Sesiidae have maggot-like endophagous larvae, which feed for one or two years (rarely up to four years). Larval development takes place either in the stems, branches, trunks or roots of trees and shrubs, or in the crowns and roots of low shrubs. In general larvae of species associated with low shrubs and which pupate in the roots, construct silken exit tubes leading to the surface of the ground from which the adult moths eventually emerge.

Table 1 The four Maltese sesiid species

| Scientific name | Host plants | Distribution |
|---|--|---|
| <i>Synanthedon myopaeformis</i> (Borkhausen 1789) ¹ | Under bark of Maloidea (<i>Malus</i> , <i>Sorbus</i> , <i>Crataegus</i> , <i>Pyrus</i> spp., <i>Eriobotrya japonica</i> Thunb., <i>Hippophae rhamnoides</i> L.) | W. Palaearctic: the nominotypical ssp. in central, W, E, parts of S Europe; ssp. <i>typhiaeformis</i> in SE France, Corsica and Italy from Liguria to Campania; ssp. <i>cruentata</i> in Calabria, Sicily and Malta; ssp. <i>graeca</i> in Greece. |
| <i>Bembecia albanensis</i> (Rebel, 1918) ² | In roots of <i>Ononis</i> spp., <i>Psoralea bitumenosa</i> L. and <i>Hedysarum caoronarium</i> L. | W. Palaearctic: W, central, S and E Europe; ssp. <i>kalavrytana</i> in Greece and Crete; ssp. <i>tunetana</i> in S Italy, Sicily, Malta and Tunisia; ssp. <i>psoraleae</i> in Iberian peninsula and S France and ssp. <i>albanensis</i> in other parts of the European range. |
| <i>Chamaesphecia aerifrons</i> (Zeller, 1847) ³ | In roots of <i>Calamintha nepeta</i> L., <i>Satureja</i> spp., <i>Thymus</i> spp., <i>Lavandula</i> spp., <i>Mentha</i> spp. and <i>Origanum vulgare</i> L. | Atlantico-Mediterranean: SW Europe, in central Europe known only from SW Germany and SW Switzerland; N. Africa. In Sardinia and Corsica as ssp. <i>sardoa</i> ; in other parts of its range as the nominotypical ssp. |
| <i>Chamaesphecia anthraciformis</i> (Rambur, 1832) ⁴ | In roots of <i>Euphorbia</i> spp. | W. Mediterranean: Corsica, Sardinia, Sicily, S and central Italy, Malta and N Africa. |

¹ This species was previously recorded from Malta as "*Sesia cruentata* Mann." by Delucca (1949) from a specimen taken from either Attard or St. Paul's Bay and another specimen captured from Birkirkara. Both Valletta (1973) and Sammut (2000) recorded this species as "*Synanthedon cruentata* (Mann.)". Valletta (1973) stated that '... it has been taken from Attard, B'Kara and Ghammieri during the months of May-June'. Sammut (2000) recorded the species from Rabat and Buskett (besides other localities mentioned in the earlier literature).

² Previously recorded by Laštůvka & Laštůvka (2001). Previous records of *Bembecia scopigera* Scop. (Valletta, 1984; Sammut, 2000) from Malta (Wardija, Wied Qirda, Wied il-Ghasel, Wied Qannotta and Wied Incita) were found to be incorrect as this material is *B. albanensis tunetana* (Le Cerf, 1920) (Laštůvka, Z., pers. comm., 2003). The ssp. *tunetana* is often considered as a distinct species and it is included as such in the Fauna Europea Project (Laštůvka, Z., pers. comm., 2003).

³ Recorded by Valletta (1984) as *Chamaesphecia* sp. near *cerifrons* Z. [misspelling of specific name] from near Slugs Bay, Mellieha.

⁴ This species was originally recorded by Caruana Gatto (1925) from Msida where he stated that this specimen could be '... una forma assai vicina alla *S. Anthraciformis* Rbr. o qualche specie affine ...'. Valletta (1973) recorded this species from B'Kara, Naxxar and Mtahleb.

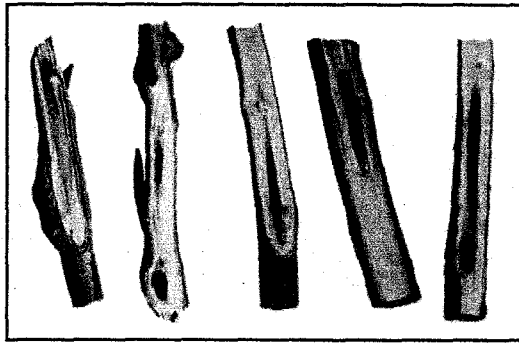


Photo A. Zammit

Fig. 1. Dissected branches from the imported *Populus alba* trees, showing larvæ and damage caused by larvæ of *Paranthrene tabaniformis*.

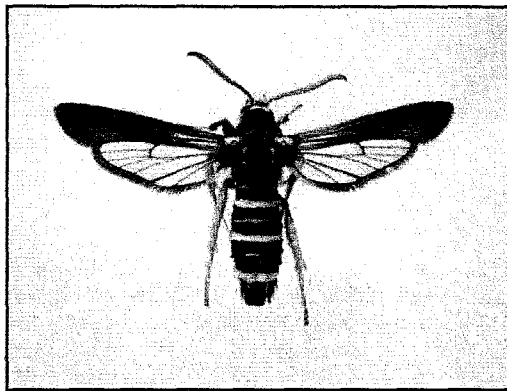


Photo P.M. Sammut

Fig. 2. Adult of *Paranthrene tabaniformis*.



Photo P.M. Sammut

Fig. 3. Empty pupal case of *Paranthrene tabaniformis* after emergence of the adult moth.

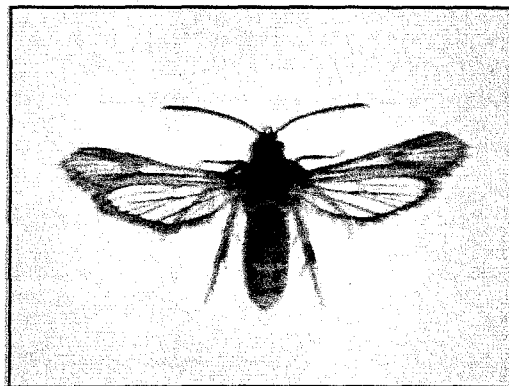


Photo P.M. Sammut

Fig. 4. Adult of *Bembecia albanensis tunetana* (Le Cerf, 1920).

On the other hand, larvae of the wood-feeding species bore to the outer surface of the host tree, leaving a thin membrane of bark to distinguish the prospective exit hole. After the emergence of the adult, the empty pupal cases protrude from these holes and often remain *in situ* for several months (Fig. 3).

Some European species of Sesiidae can often cause economic losses by regular damage to their host plants, namely fruit, ornamental and forest trees. Some examples include *Synanthedon tipuliformis* (Clerk, 1759) on currants, *S. myopaeformis* (Borkhausen, 1789) on apple trees and *Pennisetia hylaeiformis* (Laspeyres, 1801) on raspberries.

Biology of *Paranthrene tabaniformis*: In Europe, adults of *P. tabaniformis* occur from the end of May until August. The adult moths rest on twigs or foliage of the host plants, which are usually *Populus* species and very occasionally *Salix* species. The eggs are usually laid in the afternoon, and according to the mode of oviposition, different patterns of larval development may follow (Fibiger & Kristensen, 1974; Laštůvka, *Z. pers. comm.*, 2003):

- 1) Eggs are laid on twigs or suckers of the host plant. Freshly emerged larvae borrow in the bark and in the wood. They live in old galls (e.g. made by *Saperda populnea*) or they cause a similar gall; in their second year, they produce a short central tunnel in the twig;
- 2) Eggs are placed in bark crevices on trunks and branches from ground level up to the top of a tree, usually in injured or diseased places (e.g. tumors). The emerged larvae borrow in the bark and in the wood. They live in tunnels in the wood similarly as in (i);
- 3) Eggs are placed in bark crevices of very young trees, relatively near to ground level. After hatching, larvae burrow in the wood and in the roots. They produce a tunnel in the central part of trunks or in roots in which they pupate after the second hibernation. The attacked tree can perish if invaded by several larvae;
- 4) Eggs are placed on stumps of host trees. The larvae borrow in the wood of stumps or in the wood of stump suckers. The development continues as in previous cases.

The larva of *P. tabaniformis* does not produce a cocoon. It pupates in its tunnel usually after the second hibernation (one year development is exceptional) in a chamber with a thin lid. The pupa is covered only by a thin layer of bark. In Central and Southern Europe the damage of this species to poplars may be of considerable economic significance. The species is most easily located by searching for the characteristically shaped galls on suckers or on finger-wide young trees of *Populus*.

Distribution: *P. tabaniformis* is widely distributed in the Holarctic Region (present almost throughout Europe, North Africa and in large parts of Asia). The nominotypical form is present in South, Central and parts of Northern Europe whereas the spp. *synagriformis* (Rambur, 1866) is present in South Eastern France, Sardinia and in the Iberian Peninsula. In southern Italy, in Sicily and Sardinia they occur as intermediate forms, to which the specimens introduced to Malta belong.

Short description of adult *P. tabaniformis*: Wingspan 20-38 mm; proboscis present; tegula black (sometimes with short yellow border caudally, or with yellow spots caudally). Antennae light brown to black. Forewing light to dark brown without transverse cells distally. Metathorax brown to black sometimes with 2 small yellow spots and yellow rings. Abdominal segments 2, 4, 6 and sometimes 7 with yellow rings (yellow rings on all segments in ssp. *synagriformis* and in intermediate forms).

Differential diagnosis: The genus *Paranthrene* is characterised by bipectinate antennae in the males; opaque forewings, transparent basally and/or apically and valve with specialised furcate hairs dorsally.

P. tabaniformis can be readily distinguished from its congeners in Europe by the following combination of morphological characters: tegula without yellow border up to patagium, black or with yellow spots or with short yellow posterior border; metathorax without a V-shaped yellowish coloration; antennae nearly as long as one half of forewing; proboscis normal, dark brown or black; forewing without transparent cells distally; male antenna distinctly pectinate; patagial collar black or yellow only laterally.

As to the four sesiid species that occur in the Maltese Islands, *P. tabaniformis* can only be superficially confused with *Bembecia albanensis tunetana* (Fig. 4) from which it is however readily distinguished by the entirely opaque forewings (very slight transparency often found at base and exceptionally some distal transparent cells are present). In *B. albanensis*, the transparent area on forewings is large and oval in shape with a characteristic light to dark brown margin present along entire forewing margin and with yellow or orange colouration apically.

CONCLUSIONS

The imported Poplar trees were intended to be planted along the walking pathway in the Fiddien area. The western bank

of Fiddien is characterised by a number of indigenous trees such as *Populus alba* (which represent a self-regenerating population) and *Salix alba*. The latter tree is represented by stock originating from the male individual of *Salix alba* located at Gnien il-Kbir (near Buskett). Both *Populus alba* and *Salix alba* (but also *Salix pedicellata* which is also represented in the area but more towards Chadwick Lakes) are listed in Schedule 1 of Strictly Protected Trees (Tree and Woodland Protection Regulations - Legal Notice 12 of 2001).

The protection of these trees is mainly concerned with direct damage, dumping of poisonous substances, uprooting of trees, fire, vandalism, etc. However, such trees should also be protected from the accidental introduction of alien organisms (e.g. *Paranthrene tabaniformis*), which could be potentially damaging if they become locally established. A notable example was the recent accidental introduction and establishment of the longhorn beetle, *Phrynetta leprosa* (Fabricius, 1775) which is attacking trees of *Morus nigra* (also included under Schedule 1 of the Tree and Woodland Protection Regulations); this beetle is the main cause of death of the mentioned tree in the South-Western parts of Malta (Mifsud & Dandria, 2002).

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