

## NOTES ON CERTAIN LEPIDOPTERA OVIPOSITING ON PLANTS WHICH ARE TOXIC TO THEIR LARVÆ

by R. STRAATMAN

It has been observed that females of certain species of butterflies occasionally lay eggs on plants, generally belonging to the same family as the natural hostplant, but on which the larvæ did not survive. Such behaviour was described by other authors (Dethier 1942, Edwards 1935, Remington 1952) and was recently mentioned of two Sumatran Papilionidæ (Straatman & Nieuwenhuis 1961). In Queensland, Australia it has been observed in the following four species.

1. *Troides priamus richmondii* Gray is locally common in South-eastern Queensland. In March 1960, at the promontory of Burleigh Heads, 60 miles south of Brisbane, where this species is very localised, several females were observed laying eggs on *Aristolochia elegans* Mast. This plant has been introduced from Brazil and is common in the area. A total of 70 eggs were collected from several of these plants and a similar number was left untouched. From the eggs, 61 larvæ hatched in the laboratory at Samford, 14 miles N. N. W. of Brisbane, and 40 of them were reared in the insectary on *A. elegans* growing in pots. Six larvæ died in the first instar, 22 in the second and the remainder in the third instar. The other 21 larvæ had been released on plants of *A. elegans* growing outside, along the creek. About a week after their release, the plants were inspected and a number of first instar larvæ found; later inspections, however, showed only few larvæ in the second instar and none were found beyond this instar. The leaves showed but little feeding damage. In the third week of April the plants from which the eggs were collected at Burleigh Heads, were inspected carefully, but apart from many eggshells suggesting a good hatch, not a single larva was found and the leaves showed only little damage caused by feeding. Freshly laid eggs, however, were again present. A few hundred yards from these plants, larvæ of *T. priamus* were found in all instars on *Aristolochia prævenosa* F. Muell., a native species and apparently their natural hostplant. Here it forms vines climbing into the forest canopy.

Another locality where *T. priamus* occurs, but where *A. elegans* appeared to be absent, is Tamborine Mountain (1800 ft., 22 miles N. W. of Burleigh Heads). Here, *A. prævenosa* is locally common in the rain-forest and numbers of eggs and larvæ of *T. priamus* were collected and transferred to Samford. The larvæ were released on *A. elegans* growing

in pots in the insectary. At first they refused to eat and were very restless, but after two days most specimens started an irregular feeding. However, most of these larvæ died in the second week of their transfer, while larger specimens survived for four weeks, growing smaller and weaker until they died. All the larvæ which had hatched from the eggs died in the first instar.

2. *Eurycus cressida cressida* Fabricius is a common species in the Brisbane area where its host is *Aristolochia pubera* R.Br. a small plant generally found in shady places between rocks and weeds. At Samford, females of *E. cressida* were frequently observed laying eggs on *A. elegans*. Numerous eggs, which are bright orange and conspicuous, were collected and transferred to the insectary. The resulting larvæ were released on *A. elegans*, which they accepted more readily than did the larvæ of *T. priamus*, but no specimens survived beyond the third instar.

3. *Papilio demoleus sthenelus* MacLeay is the only papilionid which occurs in the dry inland areas of Australia, where EDWARDS (1948, 1955) recorded *Psoralea* (Leguminosæ) as its natural hostplant. In some years migratory flights reach the coastal areas, and in Southeastern Queensland *P. demoleus* is found every year, although sometimes locally and in small numbers. In March 1960 eggs and larvæ were found on a young *Citrus* plant near Samford and transferred to the laboratory. The larvæ continued to feed normally on leaves from the same plant until they reached the last instar. From then on they sat motionless for days, refusing to feed, and finally died. The larvæ which hatched from the eggs showed a similar behaviour and died in the last instar. When inspecting the citrus plants growing in the immediate vicinity of the tree from which the specimens had been collected, a small number of fourth instar larvæ of *P. demoleus* were found but left undisturbed. Frequent inspections showed that these larvæ also died in their final instar.

In the first week of April, numerous *P. demoleus* butterflies were seen at Samford, flying in and around a swampy paddock, which was overgrown with tall grasses and weeds. Female butterflies were seen ovipositing on a small weed, identified as *Psoralea tenax* (Leguminosæ). A search resulted in 25 eggs and 20 larvæ in various instars which were transferred to the insectary. Ten larvæ which were reared on *Psoralea*, grew rapidly and pupated. The other ten larvæ were reared on *Citrus*, accepted after a day of restlessness, but all died before pupation.

From the eggs, 24 larvæ hatched, which were divided into two feeding groups; 12 were given *Citrus* and 12 *Psoralea tenax*. The *Citrus* feeders were slow growers; while these were still in the first instar, the control specimens on *Psoralea* had reached the third instar. No *Citrus* feeders lived beyond the second instar, by which time some *Psoralea* feeders

started to pupate. Neither eggs nor larvæ of *P. demoleus* were found on *Citrus* plants growing in the immediate vicinity of the paddock. The specimens collected on *Citrus* as described were found in a much drier and hilly area where it is unlikely that *Psoralea* occurred. It was noticed that larvæ which lived on *Citrus* had a bright orange groundcolour in the fourth and fifth instars with distinct black markings, while most *Psoralea* feeders showed a green to pale yellow groundcolour with reduced black markings.

4. *Eupkæa eichhorni* Staudinger is common in Northeastern Queensland and it is supposed that its hostplants belong to the Apocynaceæ or the Moraceæ. On several occasions, females were observed in the garden around the laboratory at Ingham while laying eggs on Frangipani (*Plumeria acutifolia*, Apocynaceæ). When damaged, this plant produces a milky sap and in this respect resembles the plants which would be the normal hostplants. Numerous eggs were seen but no larvæ found, while no plants showed any damage caused by feeding. When again, a female was observed ovipositing on Frangipani, 12 eggs were collected and transferred to a petri-dish. The larvæ hatched after five days and were given young leaves of the same plant from which they were collected. However, after nibbling at the leaves they refused to feed and died during the second day after hatching.

#### DISCUSSION

Observations such as described above suggest that ovipositing butterflies are not infrequently deceived by attractive stimuli from abnormal hosts, to such an extent that eggs may be laid on plants which are, in fact, toxic to the resulting larvæ. In the case of *Aristolochia* species, this is presumably due to the close relationship of the normal host to the toxic plant. It is significant that, in the cases described, the toxic species (*A. elegans*) is an introduced plant, and there has apparently been insufficient time as yet for the butterfly to become adapted, *i.e.*, either to develop the ability to feed on it, or to discriminate during oviposition. It is perhaps also significant, that in the case of *T. priamus richmondii*, larvæ, from the area where the introduced plant does not seem to occur, died in the first instar. Those from the area where both species of *Aristolochia* occurred, did survive until the third instar, suggesting that some degree of adaptation may be evolving.

In the case of *P. demoleus*, its reported hostplants in countries other than Australia are species of Rutaceæ. However, EDWARDS (1948 and 1956) reported that in the Mitchell area (more than 300 miles west of Brisbane), *P. demoleus sthenelus* feeds on *Psoralea patens* and *P.*

*tenax* and that he was not able to rear it on *Citrus*. HELY (1958), replying to EDWARDS's paper, than stated that in 1943 and 1950 he had found larvæ and pupæ of *P. demoleus* on young citrus plants in the nursery of the Gosford Experimental Station, Narara, N. S. W. and that he had succeeded in rearing these specimens on *Citrus*. He also reported that in 1953 MOSSE ROBINSON had observed a female of *P. demoleus* ovipositing on *Psoralea affinis* in a garden at Gosford and successfully reared specimens on that host plant; also that he had collected and successfully reared larvæ on *Citrus*. Previously, WATERHOUSE (1932) had written "during 1922 on the Richmond River it occurred in thousands; if a branch of an orange-tree was held up by the hand, the females would lay their eggs on it". He also mentioned *Salvia* as a foodplant, as did RAINBOW (1907), but gave no details.

A foodplant of *P. demoleus* in Ceylon and India, mentioned by MOORE (1880), SEITZ (1927) and WOODHOUSE (1950), is *Glycosmis pentaphylla*, a rutaceous weed which also occurs in Northern and Northeastern Australia, where however, as far as is known, larvæ of *P. demoleus sthenelus* have never been found on this host.

The evidence available suggests therefore that *P. demoleus* may have developed separate local strains that differ in their association with *Citrus*: in Queensland rarely laying on and unable to develop on *Citrus* plants; in N. S. W. evidently accepting *Citrus* with complete success. It should be noted that, as in the case of *Aristolochia elegans*, plants of the genus *Citrus* are not native to Australia and it is possible that in this country *P. demoleus* became adapted to native plants of the genus *Psoralea*. With the introduction of *Citrus* plants, which are the normal hosts in other countries, it may have become possible, either for local populations of *P. demoleus* to revert to the ancestral feeding habit, or to develop *Citrus* feeding strains from eventual immigrant butterflies. No explanation can be seen, however, for the original selection of the quite unrelated *Psoralea* as a hostplant, when native species of rutaceous plants are available. In fact, as far as is known, there are no other records of a leguminous plant as the normal host of a papilionid.

In Australia several *Euplœa* species have been reported from host-plants belonging to the Apocynaceæ and the Asclepiadaceæ; members of these families generally have a milky sap.

Frangipani (*Plumeria acutifolia*, Apocynaceæ) is an introduced plant and is common in parks and gardens. As far as is known, no damage caused by *Euplœa* larvæ has ever been recorded on this plant. The normal host of *E. eichhorni* has not been described but probably belongs to one of the two above families. Once again we find that the abnormal, toxic host is an introduced plant, related to what is probably the normal

host, and presumably resembling it in the stimuli which attract ovipositing females. In this case however, there is no evidence to suggest that any adaptation to this new host has yet occurred.

#### SUMMARY

Females of four species of Australian Lepidoptera were observed ovipositing frequently on introduced plants on which the resulting larvae were unable to survive because of toxic effects. These species were *Troides priamus richmondii*, *Eurycus cressida cressida*, *Papilio demoleus sthenelus*, and *Euplœa eichhorni*. In most cases the toxic host is closely related to the normal native host plant, except in the case of *P. demoleus sthenelus*, ovipositing on *Citrus*, its normal host in other countries.

#### ACKNOWLEDGMENTS

The author expresses his sincere gratitude to Dr. D. H. COLLESS of the Division of Entomology, C. S. I. R. O., Canberra, for his advice and assistance in the preparation of this manuscript.

The writer is also grateful to Mr. M. GRAY, of the Division of Plant Industry, C. S. I. R. O., for identifying specimens of the host plants.

#### References

- Barrett, C., & A. N. Burns, 1951. *Butterflies of Australia and New Guinea*. N. H. Seward, Melbourne.
- Carpenter, G. D. H., 1946. Feeding habits of Papilionidae. *Ent. mon. mag.* 82: 276-77.
- Corbet, A. S., & H. M. Pendlebury, 1956. *The butterflies of the Malay Peninsula*, 2nd ed. 537 pp., 55 pls. Oliver & Boyd, Edinburgh.
- Dethier, V. G., 1941. Chemical factors determining the choice of foodplants by *Papilio* larvae. *Amer. nat.* 75: 61-73.
- Edwards, E. O., 1948. Notes on butterflies of Western Queensland. *Aust. zoologist* 11: 225.
- ....., 1956. The foodplants of the Chequered Swallowtail, *Papilio demoleus sthenelus* Macleay, 1826. *Proc. roy. zool. soc. N. S. W.* 1954-55: 63-64.
- Hely, P. C. 1958. The foodplants of the Chequered Swallowtail, *Papilio demoleus sthenelus* Macleay, 1826. *Proc. roy. zool. soc. N. S. W.* 1956-57:
- Moore, F., 1880-81. *The Lepidoptera of Ceylon*. 1. L. Reeve & Co., London.
- Peyerimhoff, P. de. 1949. Tableau abrégé des rapports entre les plantes et leurs parasites animaux. *Mém. hist. nat. Afr. Nord* 2: 245-265.
- Rainbow, W. J., 1907. *A guide to the study of Australian butterflies*. 272 pp., 1 pl. T. C. Lothian, Melbourne.
- Remington, C. L., 1952. The biology of Nearctic Lepidoptera. 1. Foodplants and life histories of Colorado Papilionoidea. *Psyche* 59: 61-70.
- Seitz, A., 1927. *The Macrolepidoptera of the world*. Vol. 9: 48. A. Kern, Stuttgart.
- Waterhouse, G. A., 1932. *What butterfly is that? A guide to the butterflies of Australia*. Angus & Robertson, Sydney.
- Woodhouse, L. G. O., 1950. *The butterfly fauna of Ceylon*. 2nd ed. 231 pp., 55 pls. Colombo Apothecaries' Co., Colombo.

Division of Entomology, C. S. I. R. O.,  
% B.N.G.D.C., P.O. Box 2, Port Moresby, PAPUA