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Notes on the ecology and distribution of two species of the genus *Epicopeia* in Korea and Vietnam (Epicopeiidae)

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Summary. Two species of the genus *Epicopeia* Westwood were studied in the field during entomological expeditions to Korea and Vietnam (1980–1995). *Epicopeia mencia* Moore, 1874 was recorded in northern Korea (Pyongyang env.), Palaearctic Region. *Epicopeia hainesii* Holland, 1889 was observed in northern Vietnam (Tam Dao Mts.), Oriental Region. *E. mencia* was reared successfully in the laboratory. The activity of the adults of both species in the field was observed.

Zusammenfassung. Zwei Arten der Gattung *Epicopeia* Westwood wurden auf entomologischen Expeditionen nach Korea und Vietnam (1980–1995) im Freiland studiert. *Epicopeia mencia* Moore, 1874 wurde im nördlichen Korea (Umg. Pyongyang) in der palaärktischen Region gefunden. *Epicopeia hainesii* Holland, 1889 wurde im nördlichen Vietnam (Tam Dao Mts.) in der orientalischen Region beobachtet. *E. mencia* wurde erfolgreich im Labor gezüchtet. Es wurden Beobachtungen zur Aktivität von Faltern beider Arten im Freiland gemacht.

Résumé. Deux espèces du genre *Epicopeia* Westwood ont été étudiées dans leur habitat naturel lors d'expéditions entomologiques en Corée et au Vietnam (1980-1995). *Epicopeia mencia* Moore, 1874 a été rapportée de Corée du Nord (environs de Pyongyang), en région paléarctique. *Epicopeia hainesii* Holland, 1889 a été observée dans le Nord-Vietnam (Mts. Tam Dao), en région orientale. *E. mencia* fût élevée avec succès en laboratoire. L'activité des adultes des deux espèces dans la nature fût observée.

Key words: Lepidoptera, Epicopeia, life cycle, rearing, Korea, Vietnam.

Epicopeiidae (Drepanoidea — Minet, 1991) is a small moth family distributed in the Oriental region and in the southeastern parts of the Palaearctic. Adults of this family mimic butterflies of the family Papilionidae, especially the genus *Atrophaneura*. There is little information on the distribution, biology and habitats of the Epicopeiidae (see Janet, 1913, Strelkov, 1932, Inoue *et al.*, 1982 and Yen *et al.*, 1995).

Epicopeia mencia Moore, 1874

This species was observed in northern Korea, Ryongak-san Hill in the Taedong-gang Basin, Pyongyang env., at an elevation of ca. 150–250 m ($39^{\circ}00'$ N, $125^{\circ}35'$ E): 18.VII.1985, \mathcal{F} ; 27.VII-6.VIII.1990, 200–300 $\mathcal{F}\mathcal{F}$, 3Q. This hill is covered by secondary growth, which consists predominantly of deciduous oak forest (about 200 ha). The surrounding landscape is agricultural land. For a detailed description of this locality, which is a "habitat island", see Jaroš *et al.* (1992). The adults are diurnal and heliophilous; the $\mathcal{F}\mathcal{F}$ fly usually from 15:00 until sunset. Many specimens (ca. 40/hr) were observed flying above the tree canopy. The QQ remain on the trees, and only 3 QQ were found, two of them in copula. This species was never collected at night by light trapping.

The eggs were deposited in batches of about 20-100, usually on the upper surface of leaves of Ulmus spp. They are yellow, but one day before hatching the black heads of the larvae are visible. The larvae were reared in the laboratory at 25°C (23-27°C) on leaves of Ulmus laevis Pallas. The leaves of other Ulmus species (U. minor Miller and U. glabra Hudson) appeared to be equally suitable for rearing the larvae. The mean duration of the immature stages of E. mencia is given in Table 1. After hatching, the larvae aggregate on the upper surface of a leaf but do not feed. These 1st instar larvae are coloured yellow orange, head black. After moulting to the 2nd instar, the larvae start to feed gregariously at the margin of a leaf. 2nd instar larvae are covered with white waxy powder. From the 4th instar until pupation, larvae live individually. 2nd to 6th instar larvae are of a pale brownish colour, covered with 1-3 mm of a white waxy powder, and have a black head. The full-grown 6th instar larva is about 4-6 cm long. Larval mortality in laboratory was very low, less than 3%, apparently caused by handling. No diseases were observed. The larvae pupated in the soil in a thin silken cocoon covered with the larval waxy powder. The pupa is black, about 18–22 mm long. The pupae were kept either outdoors (average temperature about $0-2^{\circ}$ C, decreasing to min. ca. -10° C), or in a cold room at $3-5^{\circ}$ C. No mortality was observed during hibernation. Adults emerged usually in June–July and fed on water with honey. Mean longevity of females (n = 25) was 15–25



Fig. 1. Epicopeia mencia in copula.



Fig. 2. Epicopeia mencia, egg batch on Ulmus leaf.



Fig. 3. *Epicopeia mencia*, 3rd instar larvae; small larvae are perhaps mimics of some mealybugs (Pseudococcidae).



Fig. 4. Epicopeia mencia, 6th instar larva.



Fig. 5. Habitat of Epicopeia mencia in northern Korea (Ryongak-san Hill).

Table 1. The mean duration (days) of the immature stages of *E. mencia* reared *ex ovo* in captivity (n = 20)

	Egg	L1	L2	L3	L4	L5	L6	Pupa
Duration	10.5	$\begin{array}{c} 1.0 \\ 0.00 \end{array}$	8.0	6.0	7.0	6.5	6.0	315.0
± SD	0.51		0.44	0.64	0.37	1.23	1.54	5.70

(max. 29) days, fecundity 150-200 (max. 271) eggs. About 100-120 eggs were deposited within 1-2 days after copulation under laboratory conditions, usually in one batch.

Epicopeia hainesii Holland, 1889

This species was observed in northern Vietnam, Tam Dao Mts., 75 km North of Hanoi, at an elevation of ca. 800–900 m (21°30' N, 105°40' E) only: 10.X.1984, \Im ; 11.–22.IX.1988, 2 \Im \Im ; 5.VI.–8.VII.1991, 5 \Im \Im , \Im ; 15.–31.VIII.1993, \Im ; 25.V.–13.VI.1995, 24 \Im \Im . The locality is a small ridge, reaching over 1200 m, covered by 19,000 ha of evergreen montane rain forest (cf. Spitzer *et al.*, 1993). The adults fly in the evening and at night, with flight activity starting just after sunset. The males fly above the trees usually from 18:00 until it becomes dark. They are readily attracted to light shortly after sunset (from 19:00 to 20:00). Only one female was caught by a light trap and no eggs were laid.

Conclusions

Epicopeia mencia is strictly associated with *Ulmus* spp. (Ulmaceae) of the East Palaearctic temperate deciduous forests (cf. Janet, 1913; Strelkov, 1932; Jaroš *et al.*, 1992; Yen *et al.*, 1995). The adults are diurnal and heliophilous with peak flight activity occurring in the afternoon. The species is monovoltine in northern Korea and it hibernates at the pupal stage. In Taiwan a polyvoltine life cycle was observed (Yen *et al.*, 1995). It is easy to rear in the laboratory. The pupa can survive the rigorous Korean winter in the soil. The laboratory mortality is very low.

Epicopeia hainesii is a subtropical-tropical species, and was collected by the authors only in the montane cloud rain forest in northern Vietnam. The food plant is not *Lindera* spp. (Lauraceae) (cf. Janet, 1913), but plants of the genus *Cornus* (Cornaceae) (Yen *et al.*, 1995). The adults are nocturnal with activity starting just after sunset and are attracted by light. The species is probably polyvoltine (bivoltine?) in Vietnam. It is stenotopic and very characteristic of tropical cloud rain forest distributed in some parts of the southern East Palaearctic Region and northern Oriental Region (Janet, 1913; Yen, 1995 and pers. comm.). The ranges of both species do not appear to overlap.

There are no records of these two species coming into contact in southern China nor in other parts of their distribution, except of Taiwan (see Heppner & Inoue, 1992 and Yen *et al.*, 1995). *E. mencia* and *E. hainesii* are mimics (probably Batesian) of *Atrophaneura* spp., and perhaps *Pachliopta* spp. (Papilionidae), which are present at the localities in Korea and Vietnam (cf. Jaroš *et al.*, 1992; Spitzer *et al.*, 1993).

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