

INSULOSCHEMA BARBARAE GEN. N., SP. N. AND TWO NEW SPECIES OF THE GENUS *KEIFERIA* BUSCK, 1939 FROM CALIFORNIA (LEPIDOPTERA, GELECHIIDAE)

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Abstract

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The gnorimoschemine taxa (of the gelechiid moths) *Insuloschema barbarae* gen. n., sp. n. and two species of the genus *Keiferia* Busck, 1939, viz. *Keiferia educata* sp. n. and *Keiferia powelli* sp. n. are described from California. The first taxon is obviously endemic to one of the most interesting Channel Islands called Santa Barbara and it corroborates its unique history. The two newly described species of *Keiferia* enrich essentially the number of species existing in California and in the Nearctic realm generally. Moths and their genitalia are figured within the description.

Gnorimoschemine moths, Gelechiidae, California, spp. n., ecology

This paper is a next contribution to a series of papers devoted to the gnorimoschemine moths of California started recently with the study of their coastal dune and scrub habitats (Powell & Povolný, 2001) and continued by additional papers finished before the issue date of the above paper, but completed later (Povolný, 1998 a, b, c; 1999 a, b; 2000; 2003). It is a result of a busy effort by Professor Jerry A. Powell, Essig Museum of Entomology, University of California, Berkeley, U. S. A. during his fieldwork and lab leaf miner rearing from indigenous succulent Solanaceae. The discovery of *Insuloschema barbarae* gen. n., sp. n., an obviously endemic gnorimoschemine taxon, corroborates the extraordinary importance and value of the smallest of the California Channel Islands and its high level of endemism. The next two new species of the genus *Keiferia* enrich their number in California. It has revealed that this material comprises a. o. obviously undescri-

bed taxa of the tribe Gnorimoschemini (Gelechiidae) enriching substantially their present knowledge (see Powell & Povolný, 2001). Their description and interpretation is the aim of this paper.

Insuloschema gen. n.

Type species: *Insuloschema barbarae* sp. n.

Derivatio nominis: Gnorimoschemine genus showing insular endemism.

Description. The forewing pattern of the moth with its irregularly disseminated blackish stigmata (see fig. 3) and comparatively broadly rounded forewing is little reminiscent of the other genera of the tribe Gnorimoschemini. The male genitalia show an unusual form of the uncus having no parallel within the tribe: it is paired and digitate. The next autapomorphy is the curious, slender parallel-sided aedeagus with shortly inflated caecum supported by a striking paired spi-

nose structure dealt with the relations in the gnorimoschemine species of the genus *Nevadopalpa* Povolný, 1998. Gnathos is a very heavy spine arising from paired branch-like base. Paired processes are shortly lobulate. The next autapomorphy is an unpaired rounded sclerite supporting the thin aedeagus above the medial excision of the sacculus wall. Regardless of these autapomorphies the only species of the genus is the member of the tribe Gnorimoschemini.

***Insuloschema barbarae* sp. n.**

(Figs. 1, 2, 3)

A small, delicate, rather nondescript moth with forewing of grey and whitish grey ground coloration with two faint black stigmata. Male genitalia rather complex, uncus bifid digitate, gnathos robust, aedeagus very long and slender supported basally by a paired elongate spine.

Description. Head, thorax and tegula essentially greyish; frons and tegula with scales showing whitish tips; labial palpus not very prominent, moderately curved, not acute, both visible segments deep grey, second segment with whitish fascia distally, third with whitish tip; forewing comparatively broad, base covered by a mixture of deeply grey to blackish scales expanding also along costa, whereas essential part of forewing center rather compactly cinereous whitish and with only two of the usual triad of blackish stigmata which are delicate, first at wing center elongate, second at discal cell, both deep black; indication of submarginal spotting at wing apex near cilia bases; scales of cinereous whitish wing center individually with blackish scales, some cilia in wing apex with blackish bases; forewing cilia grey; hindwing grey, whitish lustrous, cilia dense, grey, at hindwing tip with distinct brownish hue; legs (outside) grey to deep brown, tarsal segments with distinct whitish annuli, or black and white spotted. Forewing length approximately 4 mm.

Male genitalia

Very delicate and weakly sclerotized. Uncus tip bifid digitate; gnathos spine rather robust and distinctly sclerotized, and supported by a distinct paired sclerotized ledge; valva distinct, clavate with rounded tip not exceeding the tip of uncus, thinly haired apically; paired processes well developed, parabasal process short, broadly rounded, lobate, paired process of the sacculus wall rather membranous, distinctly shorter than parabasal process; aedeagus very long, corresponding to about 3/4 genitalia length; very slender and parallel-sided with a short, broadly inflated caecum; a very striking, paired elongate spine with prolonged slender tips and subovate base arises from the aedeagus base; at level of the membranous medial excision of sacculus wall an ungulate or but-

ton-shaped structure is seen, apparently supporting very long and slender aedeagus; saccus very distinct, with broad base and narrowed towards its slender and obtuse tip. For other details see figs. 1, 2.

Material studied: Holotype ♂, CAL(ifornia), S. Barbara Id., S. End above Cyn., 65 m 26. V. 2001, BL(ack) trap, emgd. 15. VI. 2001, *Lycium californicum*. J. Powell. (Preserved in Essig Museum of Entomology, University of California).

Comments

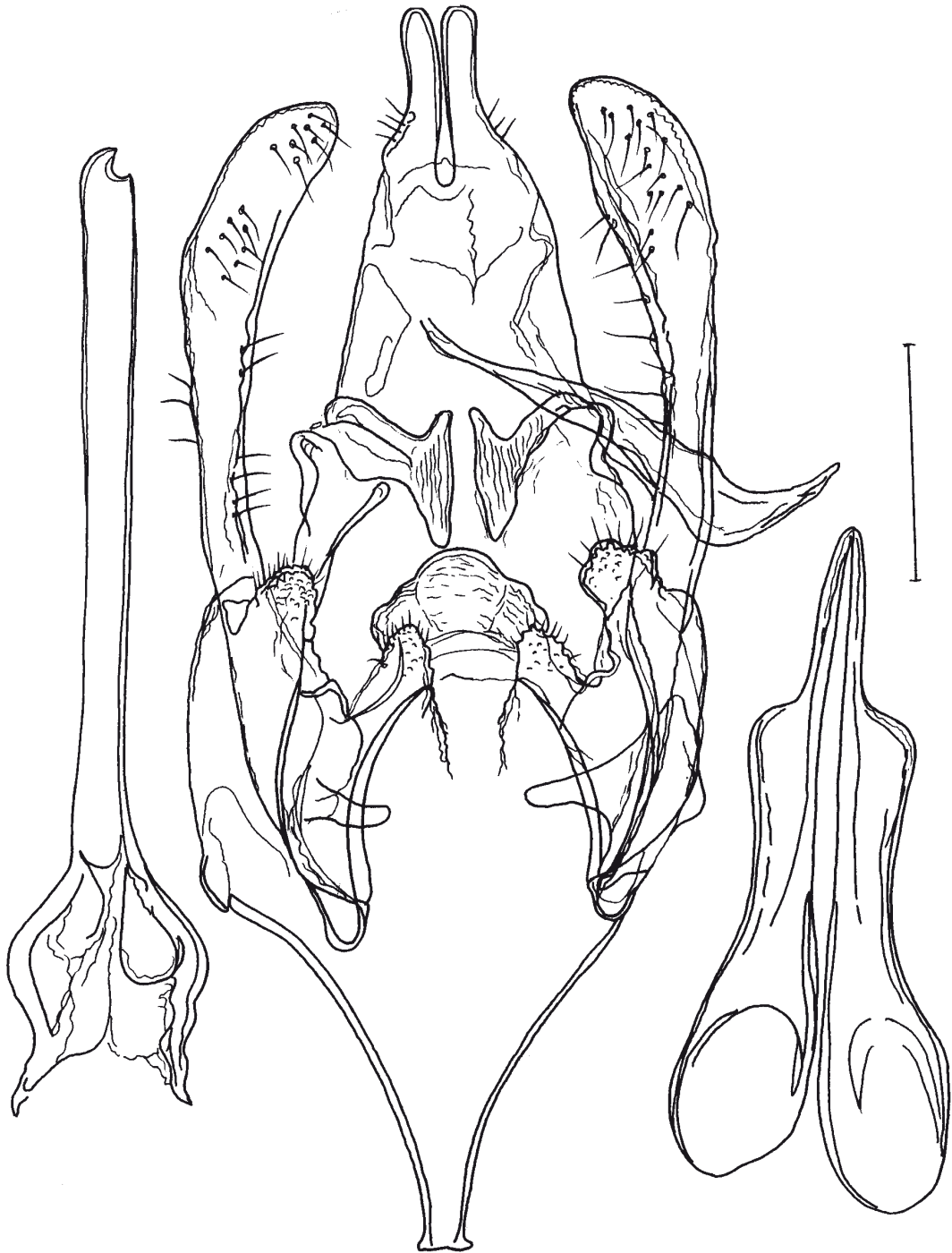
The male genitalia of this taxon indicate its unique situation within the tribe Gnorimoschemini reflected in several obvious autapomorphies, e.g. the bifid digitate tip of uncus, very strong paired arms of the gnathos with its unusually strong spine of the gnathos. The extremely long aedeagus with the supporting paired structure remember the situation in such palaearctic taxa as *Pogochaetia* Staudinger, 1879, *Tila* Povolný, 1965 and *Agonochaetia* Povolný, 1965, but they especially indicate the similarity to the species of the Nearctic endemic genus *Nevadopalpa* Povolný, 1968. The species of *Nevadopalpa* are concentrated in the eremials of California and Nevada. These genitalia characters (of the genera *Insuloschema* and *Nevadopalpa*) also indicate their gnorimoschemine status. The next autapomorphy is the peculiar unpaired „knob“ in the teguminal wall, probably supporting the aedeagus. There exist also very striking zones of little spines especially on the abdominal segments. It is obvious that the new genus does not occupy a quite isolated position within the tribe Gnorimoschemini and that it may well be associated with the Nearctic *Nevadopalpa* distributed in the opposite continent of California regardless of the fact that its above autapomorphies substantiate its generic status.

***Keiferia educata* sp. n.**

(Figs. 4, 6, 8)

A small moth, greyish with brownish tinge or brownish veins; small indistinct blackish stigmata indicated or absent; male genitalia with slender digitate paired processes.

Description. Head, thorax and tegula lead greyish, moderately lustrous, frons paler and moderately whitish; labial palpus comparatively stout, second segment with moderately erect scales rather monotonous grey, third with a paler ring centrally, tip whitish, interior side of palpus paler; forewing ground colouration deep grey with admixture of brownish scales or with irregular brownish veins; costa blackish similarly (or occasionally) as the wing center between poorly indicated minor black stigmata (or individual scales); forewing apex blackish or with a line of blackish submarginal stigmata; cilia grey with hues of grey (dark or pale); hindwing nearly uniformly grey, but paler



1: *Insuloschema barbarae* gen. n., sp. n.; ventral view of male genitalia (holotype) (middle) with aedeagus (left) and the paired structure arising from aedeagus base (right). The bar corresponds to 0.25 mm in all figures.



2: *Insuloschema barbarae* gen. n., sp. n.; a detailed view of the medial incision and the right side sacculus process with the button-shaped structure in situ (figured here in its „ungulate“ position). The robust spine of gnathos (above) is figured in its lateral position.

than forewing, blackish towards wing apex; cilia dark grey apically, pale basally; legs blackish with whitish ringlets distinct especially on tarsal segments. Forewing length 4.8 – 5.1 mm.

Male genitalia

The spine of uncus very long and parallel-sided arising from a broad but short tegumen with

shortly obtuse lateral corners; paired processes very fine but distinct and petiolate; interior pair is a slender, straight and finely haired sticklet with rounded tip; lateral paired process divergent, distinctly shorter and slenderer, also finely haired; both processes arise from a short but broad wall of sacculus; valva slender and delicate, nearly parallel-sided with rounded tip nearly not dilated apically, its base is provided with a striking subtriangulate plate with obtuse tip; saccus moderately elongate, distinctly longer than lateral edges of vinculum with rounded tip; aedeagus moderately longer than genitalia length, nearly straight, very delicate, parallel-sided, caecum moderately

subovate inflated, tip is a striking subovate sclerite, comparatively robust when compared with the slender corpus aedeagi.

Female genitalia

Subgenital plate very short and broad, caudally obtuse bilobate with distinctly protruding subovate medial sclerite and continued by an extremely long and slender funnel of ductus bursae which is only moderately shorter than extremely long and fine anterior apophyses; central part of ductus funnel distinctly wrinkled especially in its distal (caudal) part; signum distinct but delicate with broader base, petiolate, moderately curved toward its acute tip.

Material studied: Holotype ♂, CALIFORNIA, dunes of Losos, Montana State park (reared from thick leaves of a subsucculent form of *Solanum xantii*; emerged on 23. V. 1998 – J. A. Powell) 27. – 29. V. 1998; Paratypes 1 ♂, 2 ♀♀, same data (slides Pw. 1870 and Pw. 1871). (Preserved in the Essig Museum of Entomology, University of California).

Keiferia powelli sp. n.

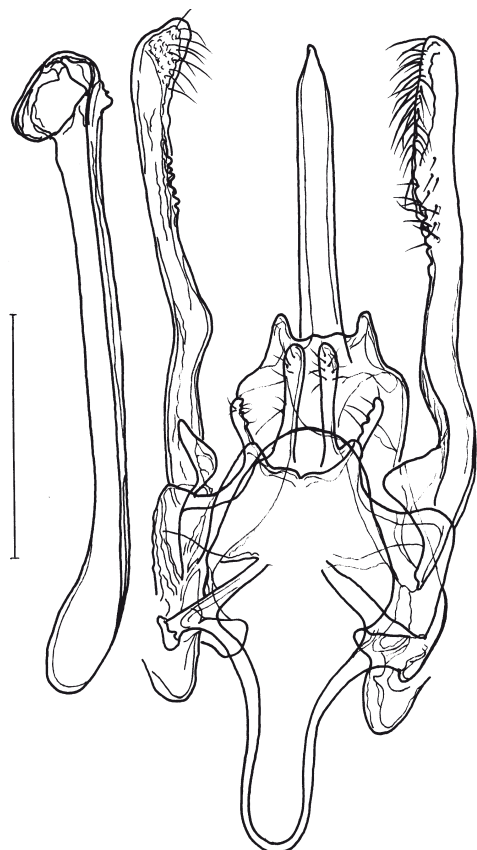
(Figs. 5, 7, 9)

A small to medium-sized moth with pale greyish to brownish forewing, pattern nondescript or absent; male genitalia with species-specific paired processes, female subgenital plate trifid, ductus bursae curved.

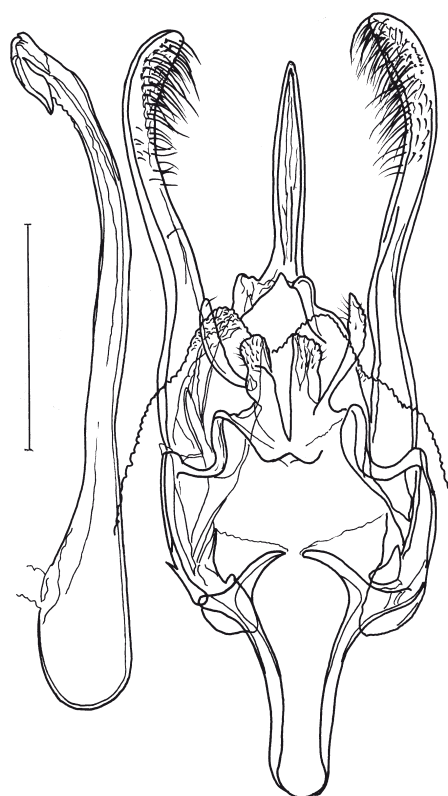
Thorax and tegula covered by cinereous scales, head paler with distinctly white frons; labial palpus cinereous grey, third segment with a whitish basal ringlet, and tip whitish; forewing ground colouration consists of a mixture of paler and darker cinereous scales,



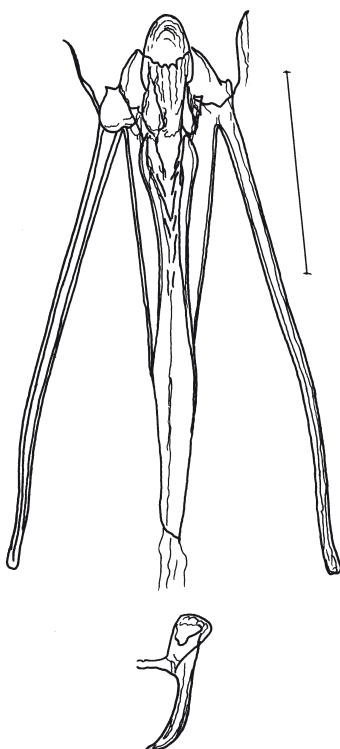
3: *Insuloschema barbarae* gen. n., sp. n.; Holotype male (A. Laštůvka pinxit). Actual size approx 9 mm.



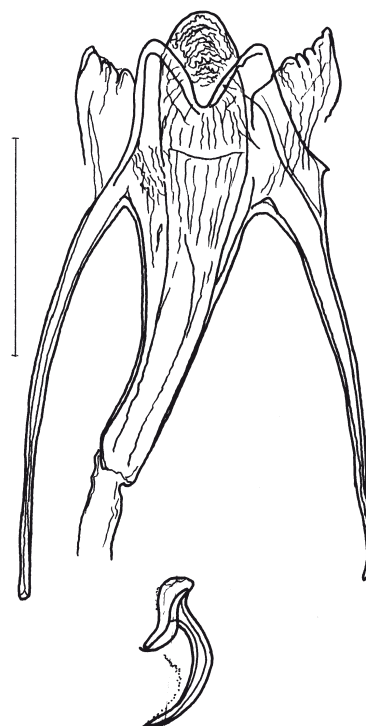
4: *Keiferia educata* sp. n.; ventral view of male genitalia (paratype) with aedeagus (left).



5: *Keiferia powelli* sp. n.; ventral view of male genitalia (paratype) with aedeagus (left).



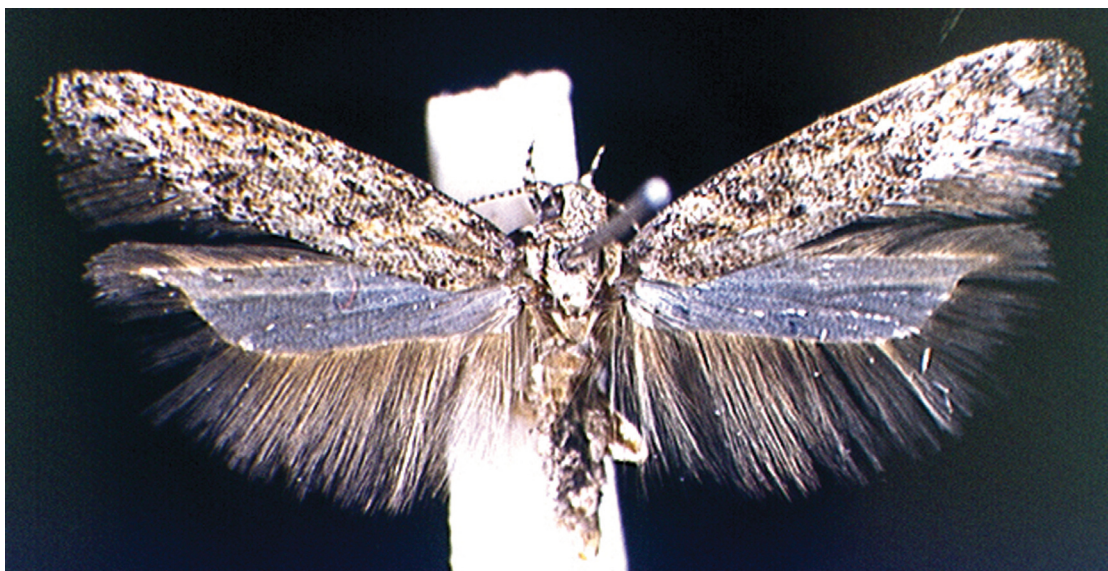
6: *Keiferia educata* sp. n.; ventral view of female genitalia (paratype) with the spine of signum bursae (bottom).



7: *Keiferia powelli* sp. n.; ventral view of female genitalia (paratype) with the spine of signum bursae (bottom).



8: *Keiferia educata* sp. n.; Paratype



9: *Keiferia powelli* sp. n.; Paratype

and with (or without) brownish longitudinal veins, in some (paler) individuals with indication of a triad of minor central blackish stigmata (or at least individual scales); a line of minor blackish submarginal stigmata in wing apex, cilia whitish grey; hindwing grey whitish, occasionally darker on costa and in wing apex; legs blackish, tarsal segments with whitish ringlets, cilia brown. Forewing length 4.9 – 5.3 mm.

Male genitalia

Uncus is a prominent long spine arising from a shortly rounded bilobate base, gnathos practically absent; paired processes are species-specific: first pair comparatively short, narrowly foliate with obtusely rounded tip, finely haired and separated by an elongate v-shaped medial excision; second pair very slender, elongate clavate with slender petiolate base, and exceeding tips of the first paired process; both paired processes arise from a double-folded sacculus wall; valva slender, moderately sigmoid with moderately spatulate tip exceeding the spine of uncus; saccus elongate unguulate, slender towards obtuse tip; aedeagus very long and slender, as long as genitalia without saccus, its base subovate inflated, tip provided with a spine.

Female genitalia

Subgenital plate very short and broad; its caudoven-tral part consists of a bilobate sclerite with a v-shaped medial incision, and with a subovate unpaired sclerite between the two lobes; ductus bursae slender elongate funnel-shaped, and distinctly shorter than very slender anterior apophyses; signum of corpus bursae is a distinct, but slender and smooth hooklet.

Material studied: Holotype ♂, San Diego County Mts. Hauser Canyon, SW of Lake Morena, 580 – 610 m; reared from xeric individuals (semidesert form) of *Physalis crassiflora*; 25. IV. 2002; Paratypes: 5 ♂♂, 9 ♀♀, same data (including slides No.JAP 8284, Pw. 1873, Pw. 1874). Preserved in the Essig Museum of Entomology, University of California).

Comments

Keiferia educata sp. n. was reared from the thick leayers of subsucculent form of *Solanum xantii* Gray growing in the dunes west of Los Osos which are a part the Montana del Oro State Park. This territory is located along the ocean coast southwest of the town Morro Bay.

As for *Keiferia powelli* sp. n., this species was reared from *Physalis crassiflora* growing along a sandstone bank where a graded road cuts through it. Most of the plants were xeric, semi-desert forms. The Hauser Canyon is situated in the mountains of San Diego County, near the Mexican border some 50

airline km east of National City on the southern edge of San Diego. The territory is designated as a Wilderness Area and is a part of the US National Forest. The above area has better protection than most Forest Service property, often used for grazing cattle or lumbering. The Canyon proper is rather woodland with chaparral.

The discoveries of these two species of *Keiferia* enrich essentially not only the gnorimoschemine fauna of California, but the number of *Keiferia* species generally. Only three species of *Keiferia* were known to occur in California (and in the Nearctic Region), viz. *Keiferia lycopersicella* (Walsingham, 1877), the notorious „Tomato Pinworm“ (not recorded, however, in native coastal communities of California, and possibly an introduced insect pest of Neotropical Origin); *Keiferia elmorei* (Keifer, 1936), a native California sibling of *K. lycopersicella*, and *Keiferia altisolani* (Keifer, 1937) a highly specialised species known to occur in the Sierra Nevada and in coastal California (Los Osos Dunes – see above and in Santa Barbara Co.). It is a leaf miner of *Solanum (xantii)*.

The above two new species belong undoubtedly to the *Keiferia lycopersicella*-*K. elmorei* group as is seen especially in their female subgenital plates showing a very similar morphotype (compare e.g. Povolný 1973; 1990, p. 208, fig. 74), and thus, to the Nearctic group of species of *Keiferia*. The Neotropical species of *Keiferia* show two different trends in the female genitalia: either an extreme prolongation of ductus bursae (e.g. in *Keiferia colombiana* Povolný, 1975 or *Keiferia vitalis* Povolný, 1990), or its strong shortening (e.g. in *Keiferia funebrella* Povolný, 1984 or *Keiferia subtilis* Povolný, 1984). The males of some Neotropical *Keiferia* show extreme specialization of the paired processes, in developing autapomorphic structures (bifurcate periaedeagal ledge, extreme shortening of saccus etc. - see e.g. *Keiferia propria* Povolný, 1990). These facts indicate that the genus *Keiferia* is essentially focused rather in the Neotropical than in the Nearctic Region. Therefore, the two species, viz. *Keiferia educata* sp. n. and *Keiferia powelli* sp. n. from California are a surprise indicating that additional undescribed species of *Keiferia* might exist in the Nearctic Region, probably in its Taxoeremic, Kansoeremic, Gilaeremic, California and Salsoeremic Centres.

ACKNOWLEDGEMENT

I feel obliged to emphasize the merits of Professor Dr. Jerry A. Powell, Essig Museum of Entomology, University of California, Berkeley, California, USA, for this paper which is based on his continuous and busy work when collecting the leaf mines and during lab rearing of moths etc. This effort has partly essential importance for the considerations of the geologi-

cal origin and age of the individual Channel Islands of California. I wish to appreciate his invitation to

contribute to this research which expands for many decades.

SOUHRN

Insuloschema barbarae gen. n., sp. n. a dva nové druhy rodu *Keiferia* Busck, 1939 z Kalifornie (Lepidoptera, Gelechiidae)

Po zveřejnění monografie makadlovek tribu Gnorimoschemini (Lepidoptera, Gelechiidae) (Powell & Povolný, 2001) pokračoval Prof. Powell v pátrání po podkopěnkách na tzv. Channel Islands a v příbřežních stanovištích tamního chaperalu na polopouštních, subsukuletních listech lílků, hvězdnic a merlíků. V zaslaném materiálu vylíhnutých makadlovek jsem zjistil zřejmě endemickou ostrovní makadlovku *Insuloschema barbarae* gen. n., sp. n. z přísně chráněného ostrůvku Santa Barbara a dva neznámé druhy makadlovek, a to *Keiferia educata* sp. n. a *Keiferia powelli* sp. n. z protilehlého kalifornského pobřeží, které popisují. Zejména endemická ostrovní makadlovka sehraje zřejmě důležitou roli při probíhajícím studiu geologického stáří tohoto ostrova a jeho vlivu na rychlost speciace druhů řádu Lepidoptera jako významné modelové skupiny. Dva dosud nepopsané druhy rodu *Keiferia* (který má těžiště v jihoamerických horských biomech) obohacují současnou znalost druhů tohoto rodu v Kalifornii.

makadlovky, Gelechiidae, Kalifornie, spp. n., ekologie

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