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Morphology and systematics of European species of *Traumatocampa* Wallengren, 1871 with descriptions of two new species from the Mediterranean region of Turkey

(Lepidoptera, Thaumetopoeidae)

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Abstract

The genus *Traumatocampa* WALLENGREN, 1871 (Lepidoptera, Thaumetopeidae) is studied and an identification key for the European and Turkish species is provided. Two new species, *T. sedirica* **sp. nov.** and *T. torosica* **sp. nov.**, from the Mediterranean region of Turkey are described and diagnostic characters of the species are illustrated.

Key words: European *Traumatocampa*, new spp., *sedirica*, *torosica*, Turkey

Zusammenfassung

Die Gattung *Traumatocampa* Wallengren, 1871 (Lepidoptera, Thaumetopeidae) wurde bearbeitet und ein Bestimmungsschlüssel für die europäischen und türkischen Arten wird präsentiert. Zwei neue Arten, *T. sedirica* **sp. nov.** und *T. torosica* **sp. nov.**, aus der Mittelmeerregion der Türkei werden beschrieben und diagnostische Merkmale veranschaulicht.

Introduction

BODENHEIMER (1941) stated that the species *Traumatocampa wilkinsoni* and *T. pityocampa* occur in Turkey, and SCHIMITSCHEK (1953) gave distribution data and reported damage caused by the pine processionea caterpillar, *T. pityocampa*, in several parts of Turkey. ACATAY (1953) studied the occurrence and control of *T. pityocampa* (= *T. wilkin-*

soni) in the Marmara Sea Islands. ACATAY (1972), TOSUN (1975), and ÇANAKÇIOĞLU (1983) reported the following *Thaumetopoea* species from Turkey: *T. pityocampa, T. solitaria,* and *T. processionea*. AGENJO (1941) studied the morphology and systematics of the Palaearctic species of *Thaumetopoea.* KIRIAKOF (1970) in his revisional work on Thaumetopoeidae, divided the family into the three subfamilies Thaumetopoeinae (with palearctic and partly oriental species), Anaphinae (with Ethiopian species), and Epicominae (with Australian species). In Thaumetopoeinae he included only *Thaumetopoea* with 8 species from Eurasia and North Africa, one species from India, and one from Ethiopia. KIRIAKOFF & TALHOUK (1975) described *Thaumetopoea libanotica* from Lebanon and compared it with *T. bonjeani* (POWELL, 1922) from Morocco. MAKSYMOV (1978) presented the biology, some morphological characteristics, parasitoids, and control of *Thaumetopoea* spp. FURTH & HALPERIN (1979) reported about 10 species of *Thaumetopoea* in the Palaearctic Region and gave information about the phenology and biogeography of *T. jordana* (STAUDINGER, 1887) and other species of the genus. FREINA & WITT (1987) revised the Palaearctic species of Thaumetopoeidae and treated 6 species in three genera from Europe and North Africa, *Traumatocampa, Thaumetopoea, Helianthocampa*, and they gave main differences of the genera and species. TSANKOV et al. (1991) worked on the shape and colour of scales from egg batches of *Thaumethopoea* species. In that work the scales were taken from egg batches and some diagnostic characters were given for the species. In Turkey, DOĞANLAR & AVCI (2001) reported the occurrence of three species, *Traumatocampa pityocampa, T. wilkinsoni* and *T. ispartaensis* DOĞANLAR & AVCI, 2001.

In none of the publications, except FREINA & WITT (1987), diagnostic characters are given for all species, and an identification key to species level has not been provided yet.

The aim of our study is to find several new good diagnostic characters for the species. For this purpose, morphological characteristics of *Traumatocampa* have been examined and an identification keys to species has been developed.

Material and methods

The moths were obtained mainly by rearing caterpillars in cages under laboratory conditions. Caterpillars of *T. pityocampa* and *T. wilkinsoni* were collected from several parts of Turkey in March 2001 and taken to the laboratory in Antakya where they were fed with needles of pine *(Pinus* spp). The academic staff of the Forestry Faculties of İstanbul, Kastamonu and Düzce also reared some specimens of *T. pityocampa*. The material of *T. ispartaensis* was reared and sent to us by Dr. M. AVCI (İsparta Forestry Faculty). Specimens of *T. sedirica* are present in the collection of the İstanbul Forestry Faculty, and specimens of *T. pinivora* were sent to us by Ulf BUCHSBAUM (Zoologische Staatssammlung München, Munich, Germany).

The identification of the species was achieved by comparing the material with identified specimens of The Natural History Museum, London, UK, the Hungarian Natural History Museum, Budapest, Hungary, and the specimens of *T. pinivora* with figures of FREINA & WITT (1987).

The scales covering the egg-batches were taken from the last tergit of the female abdomen. Measurements were taken by using an ocular-micrometer attached to a stereomicroscope. Male genitalia were obtained by dissecting the moths after boiling in 10% KOH for 5 minutes; some parts of them were separated from each other before taking

photographs. The photographs were taken using a digital camera, and drawings were done by the aid of a camera lucida attached to a stereo-microscope.

Results

Five species of *Traumatocampa, pityocampa, wilkinsoni, ispartaensis, sedirica* sp. nov., and *torosica* sp. nov., occur in Turkey. The species can be separated by the characters given in the identification keys below.

Traumatocampa WALLENGREN (Figs 1-52)

Key to species based on characters of the labial palps

1 First segment about half the length of second the segment (Fig. 3) .... *ispartaensis*
- First segment as long as or longer than second segment 2
2 First segment longer than second one (Fig. 6) ..... *wilkinsoni*
- First segment as long as second one 3
3 Segments longer than broad, not swollen (Fig. 4) ..... *pinivora*
- First segment at least slightly swollen 4
4 First segment swollen outwards, about as long as broad (Fig.1) .... *sedirica* sp. nov.
- First segment only slightly swollen, at least slightly longer than broad 5
5 Second segment with an apical incision, almost conical (Fig.2) .... *torosica* sp. nov.
- Second segment without incision, about twice as long as broad (Fig. 5) . *pityocampa*

Key to species based on characters of scales covering the egg batches

1 Extreme base of scale (root) sharply pointed (Figs 7-10) 2
- Extreme base of scale broad and placed on inner side of scale (Figs 11, 12) 5
2 Biggest scale at most 1.5 times longer than broad (Figs 8, 10) 3
- Biggest scale at least 2 times longer than broad (Figs 7, 9) 4
3 Scale with small black dots below black apical wide spot (Fig.8) .. *torosica* sp. nov.
- Scale without black dots below black apical wide spot (Fig.10) ..... *pinivora*
4 Scale with black dots below black apical wide spot (Fig. 7) ..... *sedirica* sp. nov.
- Scale with two black spots (Fig. 9) ..... *ispartaensis*
5 Scale at least 2 times longer than broad (Fig. 11) ..... *pityocampa*
- Scale at most 1.5 times longer than broad (Fig. 12) ..... *wilkinsoni*

Key to species based on characters of male genitalia

1 Valvae with an apical projection on ventral margin (Figs 54-65) and a median carina becoming thicker towards apical part (Figs 15, 17, 25, 28); tip of uncus broad, circular (Figs 18, 21, 26) 2
- Valvae without any projection, thinner apically (Figs 30, 35); tip of uncus sharply pointed, flat (Figs 32, 36, 39) 5
2 Tips of valvae sharp, turn each other, inner margin deeply concave (Fig. 25) *pinivora*
- Tips of valvae at most a short apical tooth (Figs 15, 17, 24, 54-62); inner margin at most only slightly concaved (Figs 17, 57-59) 3
3 Valvae with costal margin only slightly bent apically (Figs 22, 23, 51); costal margin of valvae as seen in fig. 54; in dorso-lateral view tip of valvae narrow (Fig. 57); ventral

side without tooth (Figs 60, 63) ..... *ispartaensis*

- Valvae with costal margin sharply bent apically (Figs 14-16, 19, 20, 52, 53) 4

4 Valvae (Figs 15, 16, 52) broad basally, apical part turn almost 95°; costal margin as seen in Fig. 55; in dorso-lateral view tip of valvae narrow (Fig. 58); ventral side with a median tooth (Figs 61, 64) ..... *sedirica* sp. nov.

- Valvae (Figs 19, 20, 53) narrow basally, apical part turn almost 120°; costal margin as seen in fig. 56; in dorso-lateral view tip of valvae broad (Fig. 59); ventral side without median tooth (Figs 62, 65) ..... *torosica* sp. nov.

5 Genitalia small; gnathos narrow apically (Fig. 31); uncus straight (Fig. 32); valvae broad basally (Fig. 34) ..... *pityocampa*

- Genitalia big; gnathos enlarged apicaly (Fig. 37); uncus turn inwards (Fig. 36); valvae narrow basally (Fig. 38) ..... *wilkinsoni*

Traumatocampa sedirica M. DOĞANLAR sp. nov. (Figs 1, 7, 13-16, 40, 41)

Thaumetopoea solitaria TOSUN, 1975:163: ÇANAKÇIOĞLU 1983: 118-119, Misident. Undescribed species: FURTH & HALPERIN 1979: 2.

Holotype: ♂, Turkey: Isparta, Sarkikaragaç, 1400m, 38°02'18"N, 31°22'35"E, ex *Cedrus libani,* 17.viii.1968 (TOSUN), in the Museum of the Agriculture Faculty, Mustafa Kemal University, Hatay, Turkey.

Paratypes: 3♀♀ 8♂♂. Turkey, Isparta, Sarkikaragaç, same locality as holotype, 17.viii.-5.ix.1967, in the Museum of the Agriculture Faculty, Mustafa Kemal University, Hatay, Turkey; 2♀♀ 17♂♂, Turkey, 1400m, 12.-29.viii.1968 (TOSUN), in the Museum of Forest Faculty, Istanbul University, Turkey.

Diagnosis: Male with forewing having apices of antemedian and postmedian fascia far from each others on anal margin (Fig. 40). Lower margin of clypeus elevated upwards, tentorial pits placed above lower margin of frontal teeth and on sides of clypeus; labial palps small, having first segment distinctly swollen upwards, as long as second segment (Fig. 1); scales covering egg-batches pointed basally, with black dots below apical black spot (Fig. 7); male genitalia having valvae broad basally, with an apical projection on ventral margin, apical 1/3 of valvae thicker, turn almost 95° (Figs 13-16); tip of uncus broad.

♂: Length 30-37 mm (holotype 35 mm). Some characters in addition to those mentioned in the keys and in the diagnosis section will are as follows: antennae yellow, bipectinate, with long hairy ramie; scapus having broad white scales and with long black hairs; head with 3-5 long broad frontal teeth, face with pale yellow long hairs between eye margin and frontal teeth; body with brownish black scales, except abdomen with golden hairs; forewing with basal, antemedian, post-median fasciae, all of them dark brown, discocellular spot light brown; hind wing white with apical fringe gray, without anal-spot.

♀: Length 33- 40 mm. Antennae with short ramie; forewing with light brown scales, without distinct fasciae (Fig. 41); hind wing as that of male; last tergit with many scales dorsally, their bases pointed.

Variation: The number and shape of frontal teeth, wing colour, number and shape of dots on scales are variable.

Affinities: FURTH & HALPERIN (1979) gave the new species as undescribed one from SW Anatolia. *Thaumetopoea sedirica* is close to species feeding on *Cedrus libani,* and *T.*

pinivora (Figs 45, 46) which feed on *Pinus* spp. It differs by characters given in the keys. *Thaumetopoea sedirica* may be close to *T. bonjeani* and *libanotica*, but can be separated by having the apices of the antemedian and postmedian fasciae on the male forewing wide apart (Fig. 40), and male genitalia with valvae having a distinct apical projection.

Biology: The host plant is *Cedrus libani* L. (TOSUN 1975; FURTH & HALPERIN 1979; ÇANAKÇIOĞLU 1983). The eggs are arranged in flat, symmetrical, hexagonal clusters on the host bark.

***Traumatocampa torosica* M. DOĞANLAR sp. nov.** (Figs 2, 8, 17-20, 42-44)

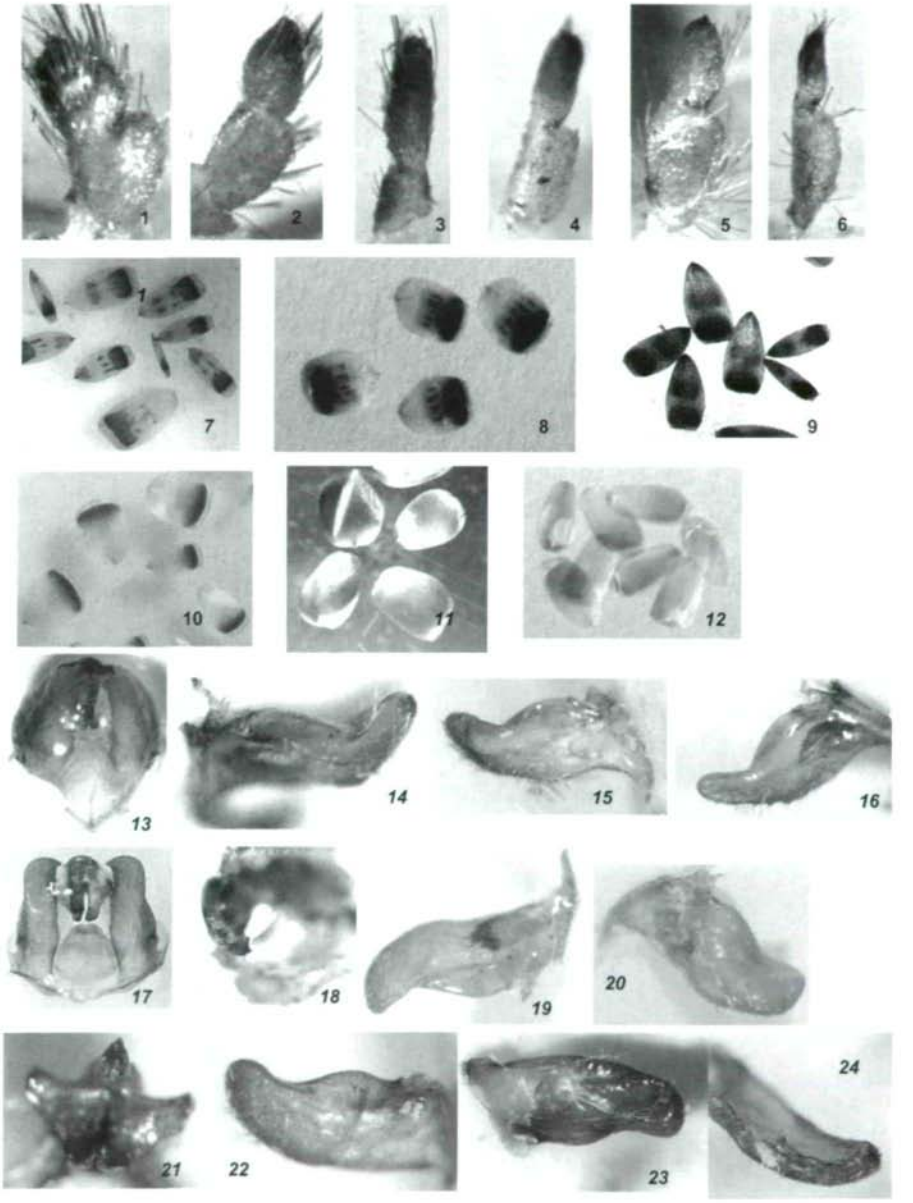
Holotype: ♂, Turkey, Adana, Pozantı, 1120m, 37°28'35''N, 34°54'17''E, ex *Pinus brutia*, 7.İx.2001 (F. DOĞANLAR), deposited in the Museum of the Agriculture Faculty, Mustafa Kemal University, Hatay, Turkey.

Paratypes: Turkey, Adana, Pozantı, same locality as holotype, ex *Pinus brutia*, 27.viii.-15.ix.2001, 13♀♀ 7♂♂ (O. DOĞANLAR); Turkey, Aladağ, 770m, 37°34'03''N, 35°23'33''E, 25.ix.2002, 7♀♀ 9♂♂ (O. & F. DOĞANLAR), in the Museum of the Agriculture Faculty, Mustafa Kemal University, Hatay, Turkey.

Diagnosis: Forewing of male with antemedian fascia narrow medially (Fig. 42); other wing patterns similar to *T. sedirica*. Lower margin of clypeus concave; tentorial pits ellipsoidal, at level of lower margin of frontal teeth; Labial palps with first segment longer than broad and than second segment, the latter almost conical (Fig. 2); the biggest scale about 1.5 times as long as broad, with longitudinal flecks below the almost triangular apical black spot (Fig. 8); male genitalia with valvae basally narrow, apices pointed, costal margin convexes in apical third to about 120° (Figs 19, 20); tip of uncus broad (Fig. 18).

Legends to Figures 1-65

1-6 labial palpus: 1 *sedirica* sp. nov., 2. *torosica* sp. nov., 3 *ispartaensis* DOĞ. & AVCI, 4 *pinivora* (TREITSCHKE), 5 *pityocampa* (DEN. & SCHIFF.), 6 *wilkinsoni* (THAMS); **7-12 scales covereing egg-batches**: 7 *sedirica* sp. nov., 8 *torosica* sp. nov., 9 *ispartaensis*, 10 *pinivora*, 11 *pityocampa*, 12 *wilkinsoni*; **13-39 male genitalia**: **13-16** *sedirica* sp. nov.: 13 ventral view; 14-16 valvae: 14 costal side, 15 ventral view, 16 dorsal view; **17-20** *torosica* sp. nov.: 17 ventral view, 18 uncus lateral view, 19 valvae dorsal view, 20 valvae ventral view; **21-24** *ispartaensis*: 21 tip of uncus and gnathos; 22-24 valvae: 22 dorsal view, 23 ventral view; 24 lateral view; **25-28** *pinivora*: 25 apices of valvae and uncus in dorsal view, 26 uncus lateral view, 27 valvae in ventral view, 28 valvae in lateral view; **29-34** *pityocampa*: 29 genitalia, 30 apices of valvae and uncus in dorsal view, 31 tip of uncus and gnathos, 32 uncus in lateral view, 33 valvae in dorsal view, 34 valvae in ventral view; **35-39** *wilkinsoni*: 35 apices of valvae in dorsal view, 36 uncus lateral view and valvae in dorsal view, 37 gnathos, 38 valvae in ventral view, 39 tip of uncus and gnathos; **40-41** *sedirica*: 40 male, 41 female; **42-44** *torosica*: 42 male, 43 egg batch, 44 fem.; **45-46** *pinivora*: 45 male, 46 fem.; **47-48** *pityocampa*: 47 male, 48 fem.; **49-50** *wilkinsoni*: 49 male, 50 fem.; **51-65 valvae drawings**: **51-53** dorsal view: 51 *ispartaensis*, 52 *sedirica*, 53 *torosica*; **54-56** costal margin: 54 *ispartaensis*, 55 *sedirica*, 56 *torosica*; **57-59** dorsolateral view: 57 *ispartaensis*, 58 *sedirica*, 59 *torosica*; **60-62** lateral view: 60 *ispartaensis*, 61 *sedirica*, 62 *torosica*; **63-65** ventral view: 63 *ispartaensis*, 64 *sedirica*, 65 *torosica*.

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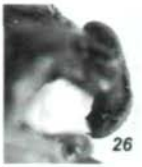
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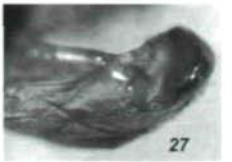
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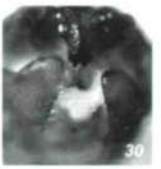
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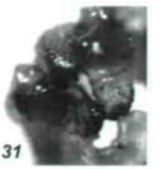
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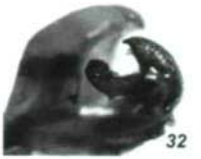
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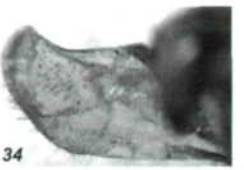
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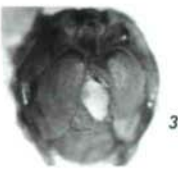
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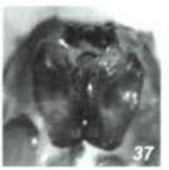
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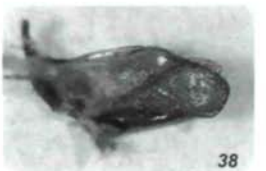
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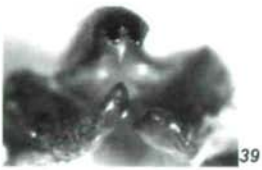
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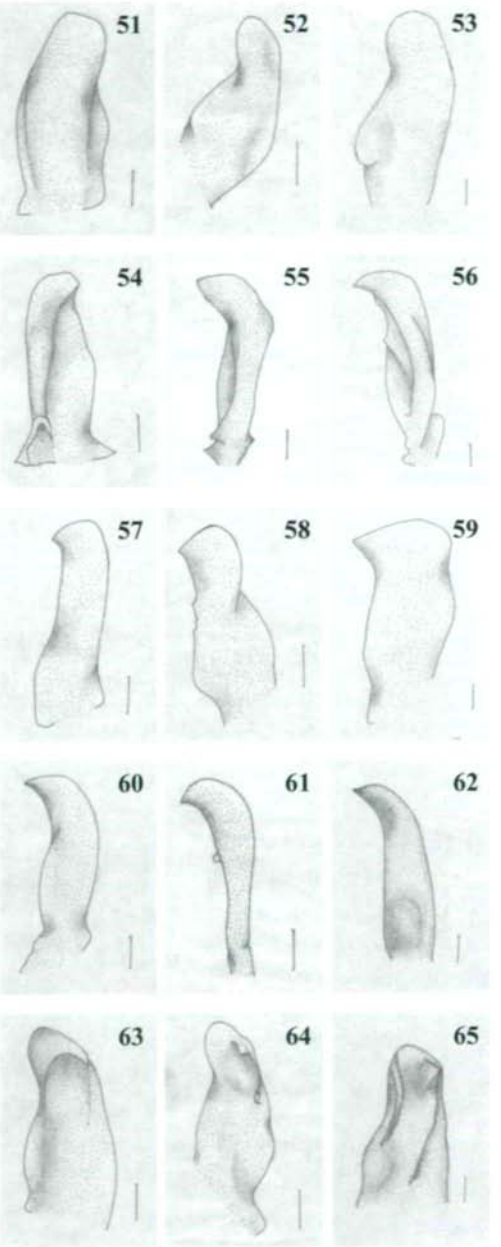

♂: Length 28-33 mm (holotype 31 mm). Some characters in addition to those of the keys and diagnosis are as follows: Antennae bipectinate, with long hairy ramie. Forewing patterns similar to that of *T. sedirica* except the antemedian fascia which is narrow medially (Fig. 42); scales on scapus, fronts, thorax and abdomen dark brown; male genitalia with gnathos small, pointed apically; uncus with apices having one pair of long sharp teeth; inner margin of valvae serrated, one of which is stronger.

♀: Forewing dark brown, fasciae slightly indicated (Fig. 44); body colour similar to male. Antennae bipectinate, with short hairy ramie; last segment of abdomen with many scales dorsally; scales almost two types, small and big ones (Fig. 8).

Variation: The number and shape of frontal teeth, and number and shape of dots of big scales are variable.

Affinities: *T. torosica* is close to *T. sedirica* and *T. pinivora* but differs from these species by characters given in the keys. *Traumatocampa torosica* may be close to *T. bonjeani* and *libanotica,* but can be separated by having the antemedian fasciae broad C-shaped medially on male forewing (Fig. 42), and male genitalia with valvae having distinct apical projection (Fig. 17) and gnathos narrower apically.

Biology: The probable host plant is *Pinus brutia* because the cylindrical egg-batches of the species were found on this tree species. However, the caterpillars were not found during the feeding period.

Discussion

Our study of several different morphological characters of species of Thaumetopoeidae from Turkey showed distinct differences in some characters, viz., male genitalia, scales covering egg-batches, shape of labial palps, shape and positions of clypeus, tentorial pits, and variation in shape of frontal processes, wing venations, and patterns on wings in some species.

The species *Traumatocampa sediria* sp. nov., *T. ispartaensis, T. pinivora* and *T. torosica* sp. nov. resemble each other in having uncus with apical part broad, emarginated costal margin and thicker apical part of valvae, *pityocampa* and *wilkinsoni* are close to each other in having uncus with apical part narrow and sharply pointed, apical part of valvae slightly bent and thin.

The shape of scales covering the egg-batches are very good diagnostic characters at species level. TSANKOV et al. (1991) also used scales characters taken from egg batches and demonstrated differences in structure, shape and colour between species. *Traumatocampa sediria, torosica, ispartaensis* and *pinivora* have similar shape of scales to *bonjeani* given by TSANKOV et al. (1991). They represent a species group characterized by the scales tapering acutely towards the basal portion. *Traumatocampa pityocampa* and *T. wilkinsoni* represent another group having broad scales with broad bases.

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Literaturbesprechung

NIEHUIS, M. 2004: Die Prachtkäfer in Rheinland-Pfalz und im Saarland. - GNOR-Eigenverlag (Gesellschaft für Naturschutz und Ornithologie Rheinland-Pfalz), Mainz. 713 S.

Auf der Grundlage von etwa 6.800 Daten werden die Verbreitung und die Phänologie von 70 Buprestidenarten in Rheinland-Pfalz und im Saarland dargestellt. Von diesen Datensätzen ausgehend konnten 853 UTM-Raster (5x5 km), die einer Rasterfläche von 21.325 km² entsprechen, mit Nachweisen belegt werden.

Das Werk beginnt mit einer Einführung, die alle Aspekte dieser Käferfamilie beleuchtet (u.a. Etymologie, Merkmale, Entwicklung, Phänologie, wirtschaftliche Bedeutung, Prachtkäfer in Kunst und Kultur). Danach geht es kurz um Zielsetzung, Material und Methodik sowie einer Beschreibung des Untersuchungsgebietes. Kernstück des Buches ist das Artenkapitel, in dem die 70 im Gebiet vorkommenden Arten ausführlich dargestellt werden. Die Artbeschreibungen beinhalten Angaben zur Gesamtverbreitung, eine Karte zur Verbreitung in Europa und Nordafrika, detailliert aufgeschlüsselte (vor 1901, 1901-1950, nach 1950, keine Nachweise) Angaben bezüglich der Verbreitung in Deutschland und natürlich die Karte mit exakten Fundorten in Rheinland-Pfalz und im Saarland. Im Text wird umfangreich auf Habitat, Wirtspflanzen der Larve, Entwicklung, Verhalten der Imagines und die Gefährdung eingegangen; ein Phänogramm bildet die Flugzeiten ab (sofern verwertbare Angaben vorlagen). Ein Glanzstück des Buches sind zweifelsohne die hervorragenden Farbfotos, meist lebend aufgenommen, ergänzt durch Habitataufnahmen und Fotos der Fraßgänge. Die Diskussion befasst sich mit "ausgewählten Anspruchsgruppen" (z.B. Auenbewohner, Steppenarten, Xerothermarten), mit der Prachtkäferfauna der Naturräume, mit Faunenelementen und Relikten (Zoogeographie), rezenten Veränderungen der Prachtkäferfauna und der Kausalität von verbreitung und Vorkommen (zoogeographische, klimatische und anthropogene Aspekte). Im letzten Kapitel wird auf die Natur- und Artenschutzproblematik eingegangen. Bleibt natürlich nur noch das umfangreiche Literaturverzeichnis und die akribischen Original-Funddaten im Anhang zu erwähnen.

Mit dieser wunderschönen und fachlich äußerst wertvollen Monographie hat sich der renommierte Autor ein weiteres Denkmal zu Lebzeiten gesetzt. Hier wurde kein Aspekt ausgelassen, so dass dieses Buch nicht nur in die Bibliothek eines jeden Koleopterologen gehört, sondern auch Zoogeographen, Entomologen, Biologen, Forstleute sowie Naturschützer und -freunde begeistern wird.

Dem Herausgeber (GNOR) und dem unterstützenden Ministerium für Umwelt und Forsten kann nur lobend gedankt werden, dass sie diese Arbeiten fördern und solche prachtvollen Werke subventionieren. R. GERSTMEIER

GOODMAN, S.M. & BENSTEAD, J.P. (eds.) 2003: The Natural History of Madagascar. - The University of Chicago Press, Chicago. 1709 S.

Wie muss man sich ein Buch mit über 1700 Seiten vorstellen? Überaus gewichtig, fast 4 kg schwer, enthält diese Mammut-Monographie alles, was man aus biologischer und ökologischer Sicht über Madagaskar wissen möchte. Es ist eine grandiose Leistung der beiden Herausgeber, diesen Band mit über 180 Autoren zusammengestellt zu haben.

Madagaskar hat sich vor etwa 160 Millionen Jahren von Afrika getrennt und bis heute einen immensen Endemitenreichtum entwickelt. Von über 12.000 geschätzten Pflanzenarten dürften fast 10.000 einzigartig für Madagaskar sein. Schätzungen über die Invertebraten-Artenzahl werden erst gar nicht gemacht. Bei Amphibien vermutet man mehr als 300 Arten in Madagaskar, bei den Reptilien sind es fast 350 (davon 346 endemisch), Vögel sind mit nur 283 Arten vertreten, bei den Säugetieren kennt man 101 Arten, inkl. der wohl bekanntesten Gruppe, den Lemuren.

Nach der üblichen Einführung beginnt dieses Werk mit der Historie der wissenschaftlichen Entdeckung Madagaskars; hier werden auch die rezenten Forscher erwähnt. Das 2. Kapitel beschäftigt sich mit Geologie und Böden; es folgen "Klima", "Wald-Ökologie", "Human-Ökologie" und eine Einführung in marine und Küsten-Ökosysteme. Ab Kapitel 7 werden Flora und Fauna vorgestellt, das letzte (14.) Kapitel ist dem Naturschutz gewidmet. Erstaunlich kurz geraten ist das 8. Kapitel über Invertebraten; die sonst überall gut bearbeiteten Coleoptera treten hier nur mit Cicindelidae und dem Tribus Enariini (Scarabaeidae, Melolonthinae) in Erscheinung. Das Buch ist reichhaltig illustriert, worunter sich auch zahlreiche Farbfotos und Farbgrafiken finden.

Dieses Kompendium ist eine unerschöpfliche Referenz für alle an Madagaskar interessierten Naturwissenschaftler und bietet darüber hinaus ganz allgemein einen hervorragenden Einblick in den Reichtum an Biodiversität auf unserer Erde. R. GERSTMEIER

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