A new *Olepa* species from Israel

(Lepidoptera: Arctiidae)

Thomas J. WITT, Günter C. MÜLLER, Vasiliy D. KRAVCHENKO, Michael A. MILLER, Axel HAUSMANN & Wolfgang SPEIDEL

Abstract

Olepa schleini sp. nov. is described from the Mediterranean Coastal Plain of Israel and compared with allied species that are all native to the Indian sub-continent. Differential analysis is based on habitus, genital morphology and mtDNA sequence analysis (COI gene). The new species is proposed to be cited according to art. 51C of the Code (ICZN), under the name *Olepa schleini* WITT et al., 2005.

Introduction

The genus *Olepa* WATSON, 1980, belongs to the *Spilosoma* genus-group (*Spilarctia* genus-group of KÔDA 1988; tribe Spilosomini; subfamily Arctiinae). It was formerly regarded as a monotypical genus represented by the single species *Olepa ricini* (FABRICIUS, 1775). This view was changed only recently by ORHANT (1986), who revived two taxa from synonymy of *ricini* to the status of valid species and described five new species from South India and Sri Lanka. Later, *Olepa* was divided in two species-groups (ORHANT 2000). The *ricini* group is characterised by a narrow uncus and valvae, which usually are pointed at the tip, whereas the valvae of the *ocellifera* group have a rounded apex and an additional sub-apical finger-shaped extension, and a broad hood-shaped uncus.

The following species belong to the *ricini* group (modified from ORHANT 2000):

- *Olepa ricini* (FABRICIUS, 1775) (*Bombyx*) with the supposed junior synonym *Phalaena zerah* STOLL, 1782 (ORHANT, 1986) (so far only known from India and Sri Lanka)
- *Olepa clavatus* (SWINHOE, 1885) (*Alope*) (India)
- *Olepa toulgoeti* ORHANT, 1986 (*Olepa*) (S. India)
- *Olepa koslandana* ORHANT, 1986 (*Olepa*) (India, Sri Lanka)

ORHANT (2000) regards *Olepa toulgoeti* as an intermediate between the two species-groups because the apexes of the valvae are slightly rounded. The rounded tips of the valvae, however, do not seem to be very constant in *O. toulgoeti*: we found that some specimens have an acute tip to the valva (cf. **fig. 24**) whereas others have rounded tips (cf. **fig. 23**), as indicated by ORHANT. *O. toulgoeti* is said to be more similar to *O. ocellifera* in this respect. The latter belongs to the second group. However, *O. toulgoeti* lacks the finger-shaped sub-apical extension of the valvae and the arrangement and structure of the cornuti seem to be so similar to *O. clavatus* that we place it here in the *ricini* group near *O. clavatus*. Both, *O. toulgoeti* and *O. clavatus* have a rather broad uncus and are in this respect transitional to the *ocellifera* group.

The following species belong to the *ocellifera* group (ORHANT 2000):

- *Olepa ocellifera* (WALKER, 1855) (*Alope*) (India, Sri Lanka)
- *Olepa anomi* ORHANT, 1986 (*Olepa*) (Sri Lanka)
- *Olepa duboisi* ORHANT, 1986 (*Olepa*) (Sri Lanka)
- *Olepa kakatii* ORHANT, 2000 (*Olepa*) (NE. India, Assam)

The two *Olepa* groups do, at least, represent a bio-species on its own. Within the two groups, the species are slightly variable in habitus and genitalia so that some species are doubtful, especially in

the *ocellifera* group. An additional difficulty in estimating the justification of the species, is the fact that many original descriptions (ORHANT 1986) are provided with figures that show the vesica either not or only partially everted from the aedeagus. The eversion of the vesica reveals the shape of the vesica and arrangement of the cornuti on the vesica, both features being diagnostic for many species in the genus *Olepa*.

It seems impossible to estimate the exact number of bio-species on the basis of the published data, especially within the *ocellifera* group. *Olepa duboisi* and *O. ocellifera* that are very similar in genitalia and appearance seem to be two separate species if the identification of the larval figures of *O. ocellifera* is correct. The larvae of both species are clearly different (ORHANT, 1986). The *ocellifera* species-group is not considered in this paper.

The new species from Israel belongs to the *ricini* group, in which *Olepa ricini*, *O. clavatus* and *O. koslandana* show very considerable differences in the structure of the vesica. They are without doubt separate species (cf. ORHANT 1986). *O. toulgoeti* is very similar to *O. clavatus* in its male genitalia therefore its status as a separate bio-species is questionable. *O. clavatus* is only known from the vicinity of Bombay and differs considerably in appearance from the South Indian *O. toulgoeti.* The hindwings of *O. clavatus* are yellow and the dark spots are conjoined and form fasciae, whereas *O. toulgoeti* has red or orange hindwings with separate dark spots. In addition, ORHANT (1986) does not cite a sympatric occurrence of both species. *O. ricini*, which has red hindwings and is widespread in India, is, apparently, rather rare in Sri Lanka (ORHANT 1986). The new species from Israel is surprisingly close to *O. ricini* in its male genitalia, and has nothing to do with the more common and widely distributed *O. ocellifera*.

Abbreviations

JMF	Collection of J. Mooser Freising, Germany
MWM	Museum Witt Munich, Germany
SCM	Collection of S. Churkin, Moskow, Russia
TAU	Tel Aviv University, Israel
ZSM	Zoologische Staatssammlung, Munich, Germany

Olepa schleini sp. nov.

(Plate 1, figs 1-4)

Holotype. ♂: Israel, Tel Aviv North, 50 m, larva Sept. 2002, e. l. November 2002, leg. G. MÜLLER, MWM.

Paratypes. Adults collected in the field:
1♀: Israel, Coastal Plain, Nahal Ayalon, south of Tel Aviv, mid-October 2000 Lf., leg. G. MÜLLER & V. KRAVCHENKO (Genitalia slide MWM 8528 ; Foto 140), MWM. 1♂: id. 10. 10. 2001, TAU. 1♀: id., leg. G. MÜLLER (Genitalia slide MWM 8529 , Foto 141), MWM. 10♂: Israel, Coastal Plain, Nahal Yarqon, north-east of Tel Aviv, early August 2002, Lf., leg. LI, MÜLLER & KRAVCHENKO, MWM. 5♂, 1§: id., TAU. 1♂: id., mid-July 2002, Lf., leg. MÜLLER & KRAVCHENKO, MWM. 1♂: Israel, Coastal Plain, Nahal Taninim, south of Ma'agan Micha'el, mid-August 2002, Lf., leg. LI, MÜLLER & KRAVCHENKO, MWM. 1♂: id., mid-September 2002, TAU. 2♂: Israel, Coastal Plain, Nahal Shiqma, south of Ashkelon, late-September 2002, Lf., leg. LI, MÜLLER & KRAVCHENKO, MWM. 1♂: Israel, Coastal Plain, Nahal Ayalon, south of Tel Aviv, late September 2002 Lf., leg. G. MÜLLER & KRAVCHENKO, MWM. 1♂: Israel, Coastal Plain, Nahal Shiqma, east of Yad Mordechai, late June 2002 Lf., leg. G. MÜLLER & KRAVCHENKO, MWM. 2♂ 1♀: id., TAU.

Plate 1, Figs 1-10. 1. *Olepa schleini* sp. nov. ♂, **2.** *Olepa schleini* sp. nov. ♀, **3.** *Olepa schleini* sp. nov. ♂, **4.** *Olepa schleini* sp. nov. ♀, **5.** *Olepa ricini* (FABRICIUS, 1775) ♂, **6.** *Olepa ricini* (FABRICIUS, 1775) ♀, **7.** *Olepa ricini* (FABRICIUS, 1775) ♂, **8.** *Olepa ricini* (FABRICIUS, 1775) ♀, **9.** *Olepa toulgoeti* ORHANT, 1986 ♂, **10.** *Olepa toulgoeti* ORHANT, 1986 ♀.

Bread specimens (♂ and ♀ not separately counted) from larvae collected in the field and reared in the laboratory:
235 ♂♀: Israel, Tel Aviv North, 50 m [Coastal Plain, Nahal Yarqon, north-east of Tel Aviv], larva [mid] September, e.l. November 2002, leg. G. MÜLLER, MWM. 231 ♂♀: Israel, 50 km S Tel Aviv, Ashquelon, 50 m [Coastal Plain, Nahal Shiqma, south of Ashkelon], larva [late] September, e.l. November 2002, leg. G. MÜLLER, MWM. 243 ♂♀: Israel, 10 km SO Tel Aviv, Highway Jerusalem – Tel Aviv [Coastal Plain, Nahal Ayalon], larva [early] October, e.l. Dec. 2002, leg. G. MÜLLER [& V. KRAVCHENKO], with genitalia slides MWM 8292 (♂), 8293 (♀), 8294 (♀), 8781 (♂), 8782 (♂), 8783 (♂), 8784 (♂), 8785 (♀), MWM. 2♂3♀: id., SCM. 50 ♂♀: Israel, Coastal Plain, Nahal Ayalon, south of Tel Aviv, collected as larvae early October, leg. G. MÜLLER & KRAVCHENKO, e.l. November 2002, TAU. 524 ♂♀: Israel, Yarkon River [Nahal Yarqon], ca.50 m, N of Tel Aviv [Coastal Plain, north-east of Tel Aviv], e. l. June 2003, [larvae collected in mid-September, 2002, by. G. MÜLLER], MWM. 413♂ 280♀: id., e.l. July 2003, leg. MÜLLER, [larvae collected in mid-September, 2002, by G. MÜLLER & V. KRAVCHENKO], MWM. 604♂♀: id., e. l. August 2003 [larvae collected in mid-September, 2002 by G. MÜLLER & V. KRAVCHENKO], MWM. 100 ♂♀: Israel, Coastal Plain, Nahal Yarqon, north-east of Tel Aviv, collected as larvae mid-September, 2002, leg. G. MÜLLER & V. KRAVCHENKO, e.l. July 2003, TAU. 50 ♂♀: id., e.l. August 2003, TAU. 516 ♂♀: Israel, ca. 100 m, 10 km East of Tel Aviv, e.l. June 2003, leg. MÜLLER, [Coastal Plain, Nahal Ayalon, south-east of Tel Aviv, larvae collected August, 2002]. MWM. 818 ♂♀: id., e. l. July 2003, [larvae collected in August, 2002 by G. MÜLLER & V. KRAVCHENKO], MWM. 224 ♂♀: id., e. l. August 2003, leg. MÜLLER [collected as larvae in August, 2002], MWM. 5♂, 4♀: Israel, Coastal Plain, Nahal Ayalon, south-east of Tel Aviv, collected as larvae August, 2002, leg. G. MÜLLER & V. KRAVCHENKO, e.l. July 2003, JMF. 300 ♂♀: MWM id., collected as larvae August, 2002, leg. G. MÜLLER & V. KRAVCHENKO, e.l. July 2003, ZSM. 200 ♂♀, id., TAU. 164 ♂♀: Israel, ca. 10 m, South of Asquelon [Ashkelon] [Coastal Plain, Nahal Shiqma], e. l. June 2003, leg. MÜLLER [larvae collected October, 2002 by G. MÜLLER & V. KRAVCHENKO], 50 ♂♀: Israel, Coastal Plain, Nahal Shiqma, south of Ashkelon, collected as larvae October, 2002, leg. KRAVCHENKO & MÜLLER, e.l. June 2003, TAU. 529 ♂♀: Israel, ca. 50 m, Magaan Michael [Coastal Plain, Nahal Taninim, south of Ma'agan Micha'el], larva leg. Oct. 2002, e. l. June/August 2003, leg. MÜLLER [larvae collected by MÜLLER & KRAVCHENKO in mid-October], MWM. 50 ♂♀: Israel, Coastal Plain, Nahal Taninim, south of Ma'agan Micha'el, collected as larvae mid-October 2002, Lf., leg. MÜLLER & KRAVCHENKO, e.l. June - August 2003, TAU. 57 ♂♀: Israel, Coastal Plain, Nahal Alexander, south of Hadera, collected as larvae October, 2002, leg. V. KRAVCHENKO & G. MÜLLER, e.l. June - August 2003, TAU. 10 ♂♀, id., MWM.

Etymology: The species is named in honour of Prof. YOSEF SCHLEIN, of the Hebrew University-Hadassah Medical School, Jerusalem, Israel. The detection of the new species would not have been possible without his generous help and consistent support of the Israeli German Project on Israeli Lepidoptera.

We propose to cite the new species, according to art. 51C of the Code (ICZN) under the name *Olepa schleini* WITT et al., 2005.

Description

Wingspan: ♂ 38-50, ♀ 60-80 mm. Head and thorax dark grey-brown; collar fringed with crimson and with a pair of pale-ringed black spots; tegulae with two pairs of spots and vertex of the thorax with one similar spot; abdomen crimson, with a series of short dorsal black bands and lateral spots. Forewing fuscous brown, with very numerous dark spots in the interspaces which lack the pale rings present in *Olepa ricini* (cf. **plate 1, figs 5-8**). Underside of the forewing with a comparatively broad, bar-shaped sub-costal hamus (male retinaculum) (**fig. 11**). Hindwing crimson, with ante-medial, medial, post-medial, and marginal bands and, more or less, conjoined blotches. ♂ with a single strong frenular bristle, ♀ frenulum consisting of 4 bristles. So far, only a few specimens were found with orange hindwings and none with yellow ones.

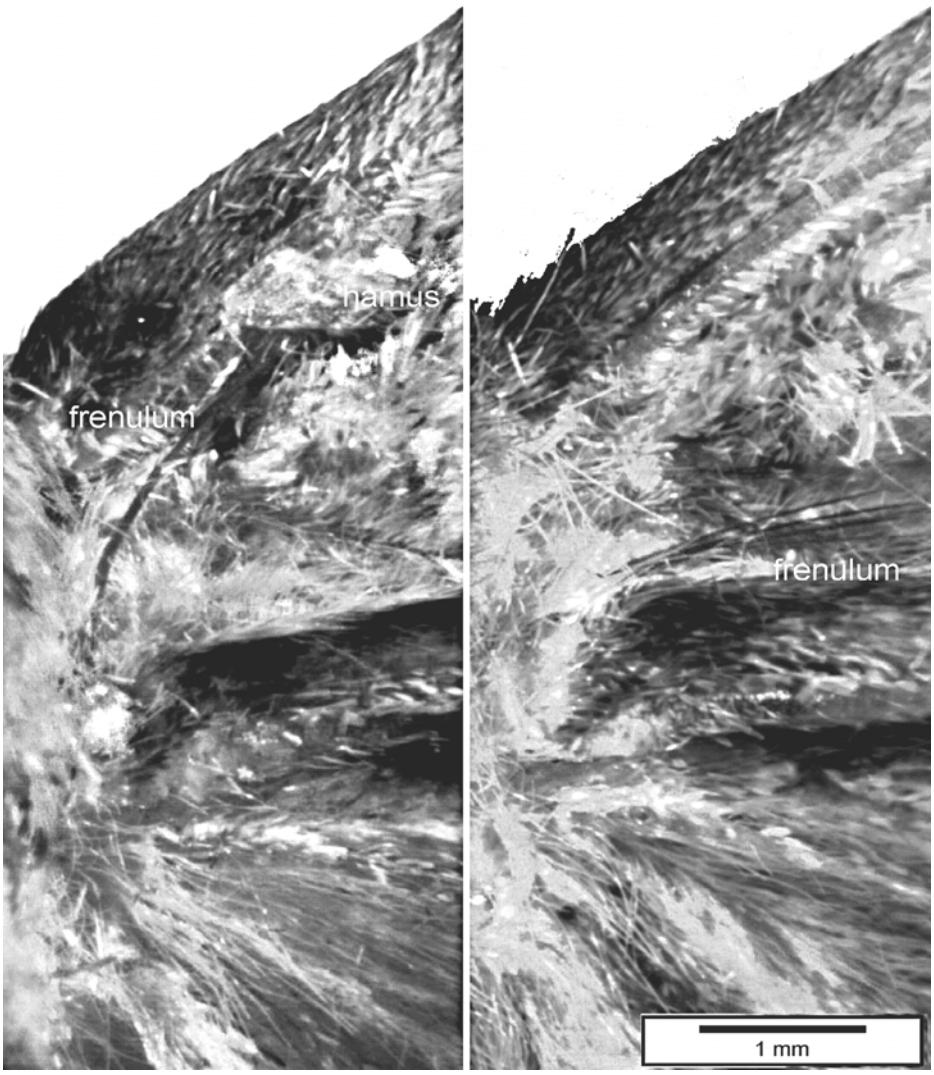

Fig. 11. *Olepa schleini* sp. nov. Underside of wing-bases, ♂ (left), ♀ (right) showing the wing coupling mechanism

Male genitalia (**plate 2**, **figs 12-17**): Uncus intimately fused with the tegumen, triangular, very narrow at the base, long and more or less acute. No membranous area (fenestrula) can be observed in the region between uncus and tegument, which is a character of the genera belonging to the *Spilarctia* (= *Spilosoma*) genus-group (KÔDA 1988). The valva is rather simple, but the inner and outer wall of the valva are widely separated and make this structure three-dimensional. Genitalia

preparations made as usual with the valvae folded out and flattened under a cover-slip result in a high deformation. The ventral margin of the valva receives a costal position after folding out. This deformation cannot be done in a standardised way and makes the individual preparations look quite different. In addition to the differences resulting from the preparations, there is, undoubtedly, also a high infra-specific variability in the form of the valva. However, in the present species, the tip of the valva is more or less rounded. This is different from *Olepa ricini* (**pl. 3, figs 18-21**), where the tip is acute in most specimens. Even the most extreme variants of both species show no overlap in this structure.

Female genitalia (**plate 5, figs 25-27**): Mid-ventrally and caudal to the 7th sternite there is an invaginated genital chamber, called "sinus vaginalis" by KÔDA (1987, 1988), which is used to characterize the *Spilarctia*- (= *Spilosoma*) genus-group. The ductus bursae is rather short and curved. The rather wide ductus seminalis originates approximately in the centre of the ductus bursae. Corpus bursae with a sclerotized, elongate structure near the entrance into the ductus. The corpus is apparently rather variable in respect to the signa, showing one or, sometimes, two rather weak traces of round signa. The same applies to *Olepa ricini,* which has also different forms of the signa, varying from almost absent to two rather easily detected structures. There is no fundamental difference in female genitalia of *O. toulgoeti*, which are shown here for the first time.

Differential diagnosis

The form of the uncus was always found to be narrow in this new species. In this respect, it constantly differs from the other members of the *ricini* group, except for *Olepa ricini* and *O. koslandana*. The latter is easily recognized by its asymmetrical valvae and other characters in the male genitalia, which are considerably different. *O. koslandana* does not seem to be closely related to *O. schleini* sp. nov. or *O. ricini*. *O. schleini* sp. nov. and *O. ricini* have very similar genitalia in both sexes: The male genitalia show a slight but constant difference in the form of the valvae, which are, terminally, more or less acute and more slender towards the apex in *O. ricini*, whereas it is always terminally rounded in the new species. *O. clavatus* and *O. toulgoeti* have very similar male genitalia and seem to be closely related to each other (cf. *O. toulgoeti*: **plate 4, figs 22-24**). Both are provided with a, basally, rather broad uncus and they also differ in the form of their valvae and in the comparatively large cornuti of *O. ricini* and *O. schleini* sp. nov.. *O. clavatus* has an acute end to the valvae and yellow hindwings, wheras *O. toulgoeti* has a rounded end to the valvae and orange hindwings and is, in this respect, much closer to *O. ricini* and *O. schleini* sp. nov. than *O. clavatus*. By DNA analysis, unexpectedly, *O. toulgoeti* proved to be closer to *O. schleini* sp. nov. than was *O. ricini*. More informative characters and longer sequences are needed before the relationships within the *ricini* group can be finally determined.

Distribution: Along the Coastal Plain of Israel.

Zoogeography: Israel with its alternating geographical and climatic zones is a common ground for plants and animals of different zoogeographical origin (FURTH 1975; KLEIN 1988; ANONYMOUS 1970). Though the country is comparatively small, it is known for its complex and unique mixture of Euro-Siberian, European, Mediterranean, Central-Asian, Arabian, Ethiopian and Oriental fauna (KOSSWIG 1955; BYTINSKI-SALZ 1961; POR 1975). Additionally, many insect species have been accidentally introduced into Israel over the last decades (BYTINSKI-SALZ 1966; TCHERNOV & YOM-TOV 1988). Hence, each new record needs careful examination to check whether an already known species is found at its furthest point of distribution, a neozoon was introduced or a taxon is truly new to science.

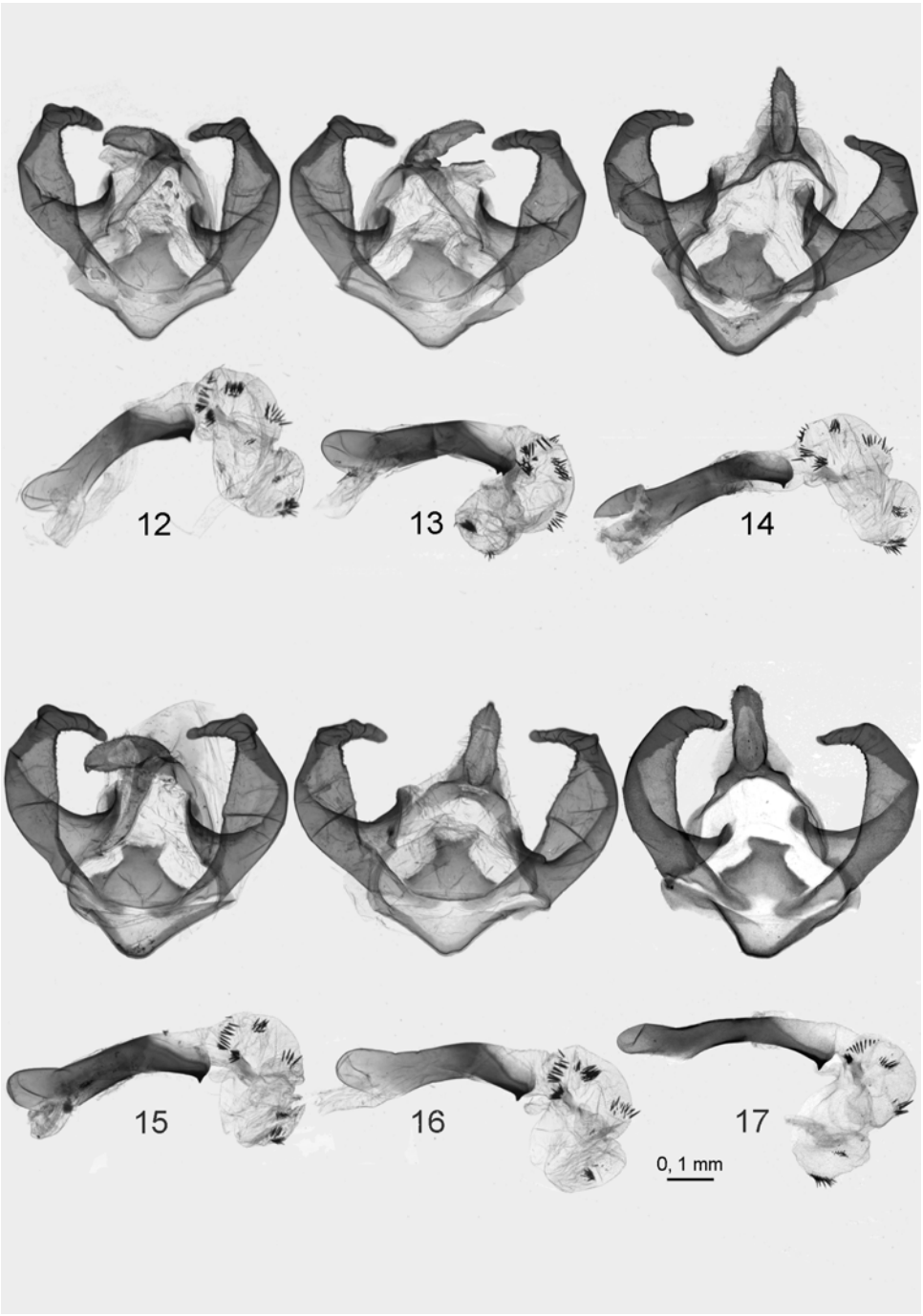

Plate 2: Figs 12-17.: Male genitalia of *Olepa schleini* sp. nov.

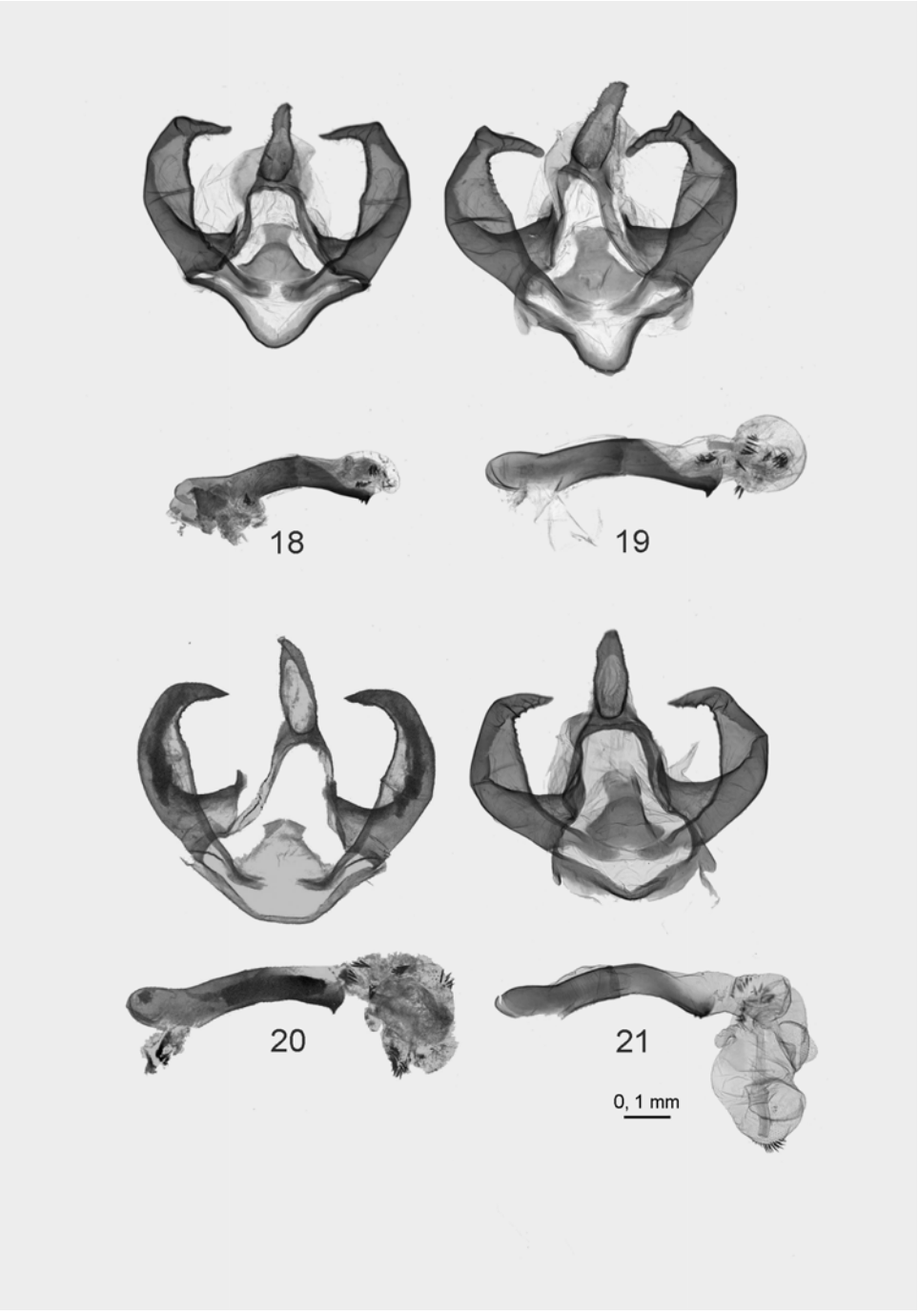

Plate 3: Figs 18-21.: Male genitalia of *Olepa ricini* (FABRICIUS, 1775)

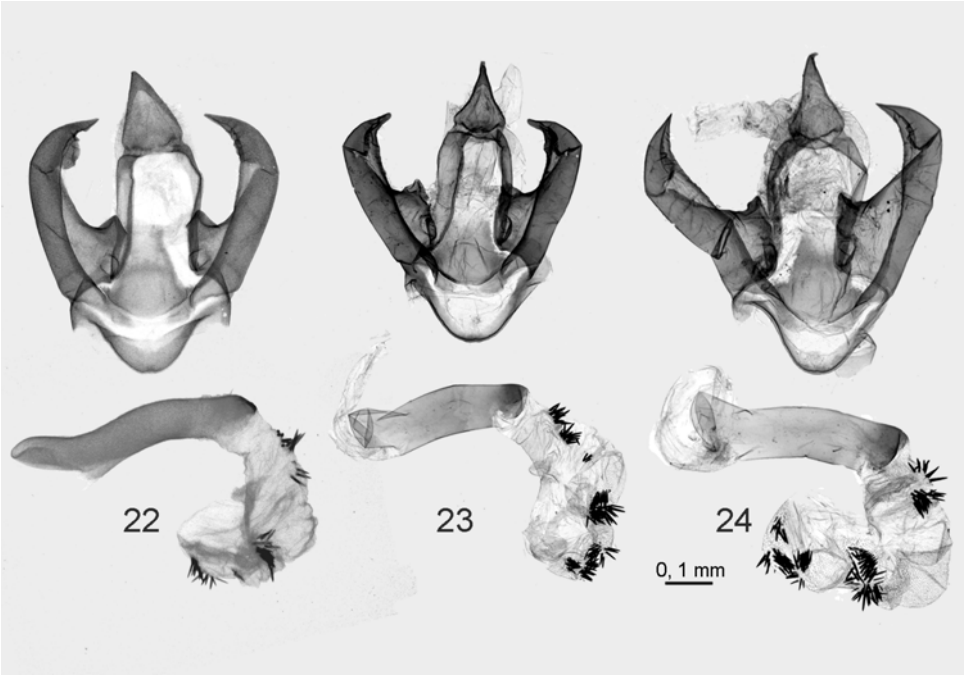

Plate 4. **Figs 22-24.** Male genitalia of *Olepa toulgoeti* ORHANT, 1986

Arctiidae, however, belong to the best-known families of Lepidoptera and, until now, nowhere a species has been found, that matches *O. schleini* in habitus or morphology. DNA-analysis of different *Olepa* species revealed remarkable differences from the Oriental *Olepa ricini,* which is the most similar species in habitus. The Indian sub-continent, in which the other known *Olepa* species are distributed, has been well explored. Also, good fauna inventories exist for the countries between Israel and India (Pakistan, Iran, Iraq, Jordan and Saudi Arabia), but they do not contain any record of an *Olepa* species.
Therefore, the occurrence of the species in the Mediterranean coastal marshes and its absence west of India is a strong argument in favour of its being an old relict species.

Olepa schleini sp. nov. is not the only archaic tropical element within the Mediterranean zone of Israel (TCHERNOV & YOM-TOV 1988). Depending on insect order and family, up to several percent of the Israeli fauna are Oriental elements (KUGLER 1988; FREIDBERG 1988; BENYAMINI 2002).

The accidental introduction of an *Olepa* species from India through the Suez Canal to the Mediterranean Coast of Israel seems very unlikely, especially when considering the strict measurements of the Israeli Plant Quarantine Service, which have existed for many decades (BYTINSKI-SALZ 1966). The frontiers with neighbouring countries are almost closed and there is no need to introduce *Ricinus,* which is a pest in Israel (the larvae of the new species are monophagous on *Ricinus*). GOATER & HONEY (2003) reported the accidental introduction of *O. ricini* 1992 into England under the name *'Pericallia ricini'*. However, the genitalia of this badly worn specimen, are not shown in the publication. The prominent C-shaped cell spot on the forewing excludes it from being a specimen of *O. schleini*. An introduction from India is very likely as already suggested by GOATER & HONEY (2003).

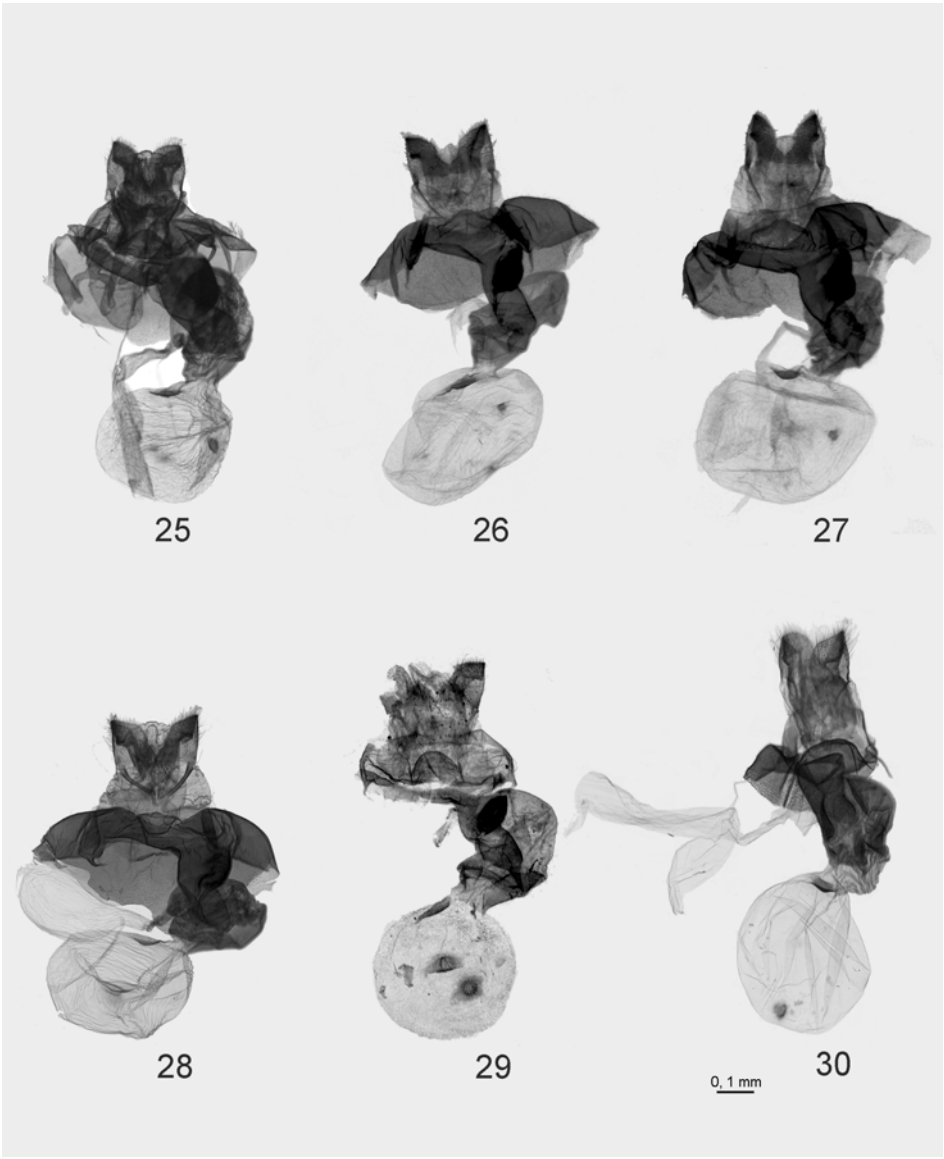

Plate 5. **Figs 25-30. 25-27.** Female genitalia of *Olepa schleini* sp. nov.; **28, 29.** *Olepa ricini* (FABRICIUS, 1775); **30.** *Olepa toulgoeti* ORHANT, 1986

Phenology: Two generations with a partial third one were confirmed by rearing experiments under natural conditions. Adults were collected in the field from mid-May to mid-November with a main flight period from July to September. Larvae were found in the field from early June to mid-October.

Remarks: Additional informations on larval morphology, rearing, host-plant, distribution, phenology, ecology, behavior and conservation issues will be published separately.

Mitochondrial COI gene DNA sequence analysis

Material

DNA was extracted from at least five specimens of each population of the following species (* = successfully sequenced). Twenty-five specimens were examined, each labelled with the DNATAX-number.

(1) *Olepa schleini* sp. nov. (paratypes from the Israeli Coastal Plain): Pinned, dry specimens, unrelaxed: Western Israel, 10 km SE Tel Aviv, Highway Tel Aviv-Jerusalem, larva Oct., e. l. Dec. 2002, leg. G. MÜLLER, MWM (DNATAX02723*; DNATAX02724*; DNATAX02725*; DNATAX02726*; DNATAX02727*) ; Israel, ca. 10 m, South of Asquelon, e. l. June 2003, leg. MÜLLER (1 specimen) (DNATAX02878*); Israel, ca. 100 m, 10 km East of Tel Aviv, e. l. July 2003 leg. MÜLLER (1 specimen) (DNATAX02879*); Israel, 50 km S Tel Aviv, Ashquelon, larva September, e. l. November 2002, leg. G. MÜLLER (1 specimen) (DNATAC02880*); Israel, ca. 50 m, Magaan Michael, larva leg. Oct. 2002, e. l. June/Aug. 2003, leg. MÜLLER (1 specimen) (DNATAX02881*); Israel, Yarkon river, ca. 50 m, N. of Tel Aviv, e. l. June 2003, leg. MÜLLER (1 specimen) (DNATAX02882*); Israel, Yarkon river, ca. 50 m, N. of Tel Aviv, e. l. August 2003, leg. MÜLLER (1 specimen) (DNATAX02850*)

(2) *Olepa toulgoeti*: spread specimens that had been relaxed for preparation. None of the specimens collected in 1997 from Kerala and Theimala gave a positive result, whereas two Tamil Nadu specimens from 1990 were successfully sequenced: S. India, Kerala, Theimala n. Shencottah, 70 km N Trivandrum, 150 m, 4. iv. 1997, leg. SCHINTLMEISTER & SINIAEV, MWM (DNATAX02738, DNATAX02739, DNATAX02740; DNATAX02741*; DNATAX02742*); S. India, Tamil Nadu, Yercaud NW Salem, 1200 m, 16. vii. 1990, leg. Dr. W. THOMAS, MWM (DNATAX02733; DNATAX02734, DNATAX02735, DNATAX02736, DNATAX02737).

(3) *Olepa ricini*: „ex pupa“ and probably immediately spread without previous relaxation: SE. India, Madurai, e. p. 4. xii. 1986, leg. KREUZER, MWM (DNATAX02728*; DNATAX02729*; DNATAX02730*; DNATAX02731*; DNATAX02732*; DNATAX02849).

The mitochondrial (mtDNA) cytochrome oxidase subunit I (COI) gene was amplified by PCR. Complete COI sequences (1530 bp) were obtained from *Olepa schleini* (GenBank ass. no. AM050270-AM050276) after successful sequencing. Ten specimens of the new species (GenBank ass. no. AM050270-AM050279), five specimens of *O. ricini* (GenBank ass. no. AM050280-AM050284) and two specimens of *O. toulgoeti* (GenBank ass. no. AM050285-AM050286) furnished a homologous, 528 bp fragment (positions 301-828 in the COI gene).

Results of the sequence analysis

1. Infraspecific variability: In seven specimens of the new species *Olepa schleini* sp. nov., the complete COI gene (1530 bp) was sequenced; no infra-specific variability was seen (variability: 0% sequence diversity). The five specimens of *O. ricini* revealed no infra-specific variability (0% sequence diversity in the sequenced 528 bp COI fragment). The two successfully sequenced specimens of *O. toulgoeti* showed a single nucleotide polymorphism at position 490 (p = 0,0019 within the sequenced 528 bp COI fragment).

2. Genetic difference between *Olepa schleini* sp. nov. and *Olepa ricini*: Both populations differ in 83 nucleotides of the sequenced 528 bp fragment of the COI gene (p = 0,1572). Informative positions are compiled in **Tab. 1**.

3. Genetic difference between *Olepa toulgoeti* and *Olepa ricini*: Both species differed in 78 nucleotides of the sequenced 528 bp fragment of the COI gene (p = 0,1477). Informative positions are compiled in **Tab. 1.**

4. Genetic difference between *Olepa schleini* sp. nov. and *Olepa toulgoeti*: Both species differed in 14 nucleotides of the sequenced 528 bp fragment of the COI gene (p = 0,0265). Informative positions are compiled in **Tab. 1.**

Tab. 1: Variability in the fragment (pos. 301-828) from the mitochondrial COI gene of *Olepa schleini*, *Olepa ricini* and *Olepa toulgoeti*. A= Adenosine, C = Cytidine, G = Guanosine, T = Thymidine; M – G or T

Pos	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 4 4 4 4 4 4 4 4
	0 0 0 1 1 1 1 1 2 2 3 4 5 5 5 5 6 7 8 8 9 0 1 1 1 2 2 3 3
	3 4 6 2 5 6 8 9 2 4 3 5 0 1 4 5 3 5 5 7 0 8 4 7 8 0 7 8 9
O. schleini	T T A A A C A A T A A A A T A G A T C T T T T A G A G C C
O. ricini	A C G T T A T G C T T G G C G T T A T A A A A T A T A A T
O. toulgoeti	T T A G A C A A T A A A A T A G A T C T T T T A G A G C C

Pos	4 4 4 4 4 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 6 6 6 6 6
	4 5 6 7 8 9 0 1 2 4 5 5 6 7 7 7 7 7 8 8 8 8 9 9 0 0 0 1 1
	4 0 2 4 6 0 1 7 8 6 0 5 7 0 4 6 7 9 0 2 6 8 1 4 0 3 6 6 8
O. schleini	T A A T T A T C C C G A T C C T C T C T C T T T T G T C T
O. ricini	C T T A C A C A T T T G A T T A T A T A T A A A A A C T A
O. toulgoeti	T A A T T M T T C T G A T C C T C T C T C T T T T A T C T

Pos	6 6 6 6 6 6 6 6 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 8 8 8 8
	3 4 5 5 6 6 7 7 8 8 0 1 1 2 4 4 5 5 5 6 6 8 8 9 1 1 2 2
	9 2 1 4 0 9 5 9 1 4 8 1 4 0 7 8 3 6 9 6 8 0 6 2 3 9 3 8
O. schleini	T A C T T G T C T C A C A T G A C T T T C G G C T A T T
O. ricini	C T T C A A A T A T C T T A T A T C A T A A A T C T A A
O. toulgoeti	T A C T T A T C T T A T A T T T T T T C T G G T T A T T

Discussion of sequence analysis

1. Infra-specific variability: In Israel, five adult specimens originating from a single batch of eggs and five adults from five different colonies were sequenced. Mitochondrial genetic identity exists among specimens originating from the same female parent (DNATAX02723 – DNATAX02727). However, infra-population genetic identity was also revealed by analysis of material from several different localities. The occurrence of one single haplotype throughout the whole distribution area of *O. schleini* can be explained by either a homogenous gene pool owing to high dispersal and a consequent complete mixing of individuals within the restricted distributional area, or by a 'bottleneck' which the species had to pass (i.e., by a past reduction of the population to a few individuals).

Such phenomena have been studied in detail for the almost extinct populations of the African cheetah, *Acinonyx jubatus* (MENOTTI-RAYMOND & O'BRIEN 1993). It is also known in island populations, e.g., the giant tortoise (*Geochelone nigra vandenburghi*) from the Galapagos archipelago (BEHEREGARAY et al. 2003). The suggestion of a 'bottleneck' in the population of *O. schleini* is supported by our observation of comparatively low dispersal and high fluctuation of the population size in the Israeli populations.

2. Inter-specific variation: The extremely high level of genetic variation in the mt COI gene between *Olepa ricini* and *O. schleini* sp. nov. clearly shows that both taxa are different bio-species. Similarly, great differences found between the Indian *O. ricini* and *O. toulgoeti* confirm the status of these two species. A difference of 2,65% between the new species *O. schleini* sp. nov. and *O. toulgoeti* is well above the usual infra-specific values (HEBERT et al. 2004). Hence it is clear that the Israeli population cannot be explained by colonization or transport in recent times of any of the other sequenced Indian species.

The most interesting result from this molecular analysis is that the new species appears to be close to *Olepa toulgoeti.* Nevertheless both species are quite different in their male genitalia, although both belong to the *ricini* species-group. The vesica of *O. toulgoeti* has much longer terminal cornuti than that of *O. schleini* sp. nov.. In addition, the uncus is broader and the valva is shorter in *O. toulgoeti*.

Zusammenfassung

Olepa schleini sp. nov. wird aus der mediterran geprägten, westlichen Küstenebene Israels beschrieben und mit den verwandten Arten des indischen Subkontinents verglichen. Die Differentialanalyse umfaßt Färbungsmerkmale, äußere und innere Morphologie, sowie die Ergebnisse einer mtDNA Sequenzanalyse (COI Gen).

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Appendix : Detailed data on figured specimens

Fig. 1. *Olepa schleini* sp. nov. ♂: Israel, Tel Aviv North, 50 m, larva Sept. 2002, e. l. November 2002, leg. G. MÜLLER, MWM. Holotype. **Fig. 2.** *Olepa schleini* sp. nov. ♀: Israel, Tel Aviv North, 50 m, larva Sept. 2002, e. l. November 2002, leg. G. MÜLLER, MWM. Paratype. **Fig. 3.** *Olepa schleini* sp. nov. ♂: Israel, Tel Aviv North 50 m, August 2002 Lf., leg. LI & MÜLLER & KRAVCHENKO, MWM. Paratype. **Fig. 4.** *Olepa schleini* sp. nov. ♀: Israel, Coastal Plain, Nahal Ayalon, south of Tel Aviv, mid-October 2000 Lf., leg. G. MÜLLER & V. KRAVCHENKO, MWM. Genitalpräparat Heterocera Nr. 8528 MWM. Paratype. **Fig. 5.** *Olepa ricini* (FABRICIUS, 1775) ♂: S. India, Tamil Nadu, Nilgiri Hills, south slopes, 10 km SE Katagiri, 900 m, 11°23' N. L. 76°55'E. B., Evergreen dry forest, 16. iv. 97, 19°C/1 a. m., leg. SCHINTLMEISTER & SINIAEV. MWM. **Fig. 6.** *Olepa ricini* (FABRICIUS, 1775) ♀: 9. 12. 1986, S/O. Indien, Madurai, ♀ e. p., leg. KREUZER, MWM. **Fig. 7.** *Olepa ricini* (FABRICIUS, 1775) ♂: 10. 5. 1976, Madurao, SO-Indien, e. p. KREUZER, MWM. **Fig. 8.** *Olepa ricini* (FABRICIUS, 1775) ♀: 10. 4. 1986, S/O. Indien, Madurai, e. p., leg. KREUZER, coll. G. KREUZER, MWM. Genitalpräparat Heterocera Nr. 8515 MWM. **Fig. 9.** *Olepa toulgoeti* ORHANT, 1986 ♂: Indien mer., Tamil Nadu, Vercaud nw Salem, 1200 m, 16. vii. 1990, leg. Dr. W. THOMAS, MWM. **Fig. 10.** *Olepa toulgoeti* ORHANT, 1986 ♀: S-India, Kerala, Theimala n. Shencottah, 70 km N Trivandrum, 8°57'N 77°91'E, 150 m, 4. iv. 1997, leg. SCHINTLMEISTER & SINIAEV, MWM. **Fig. 11.** *Olepa schleini* sp. nov.: Israel. 10 km SO Tel Aviv, Highway Tel Aviv-Jerusalem, larva Oct., e. l. Dec. 2002, leg. G. MÜLLER, MWM. **Fig. 12.** *Olepa schleini* sp. nov. Genitalia slide MWM 8784 . Israel, 10 km SO Tel Aviv, Highway Jerusalem – Tel Aviv [Coastal Plain, Nahal Ayalon], larva [early] October, e. l. Dec. 2002, leg. G. MÜLLER [& V. KRAVCHENKO]. **Fig. 13.** *Olepa schleini* sp. nov. Genitalia slide MWM 8781 . Israel, 10 km SO Tel Aviv, Highway Jerusalem – Tel Aviv [Coastal Plain, Nahal Ayalon], larva [early] October, e. l. Dec. 2002, leg. G. MÜLLER [& V. KRAVCHENKO]. **Fig. 14.** *Olepa schleini* sp. nov. Genitalia slide MWM 8529 . Israel, Coastal Plain, Nahal Ayalon, south of Tel Aviv, 10. 10. 2001 Lf., leg. G. MÜLLER. **Fig. 15.** *Olepa schleini* sp. nov. Genitalia slide MWM 8783 . Israel, 10 km SO Tel Aviv, Highway Jerusalem – Tel Aviv [Coastal Plain, Nahal Ayalon], larva [early] October, e.l. Dec. 2002, leg. G. MÜLLER [& V. KRAVCHENKO] **Fig. 16.** *Olepa schleini* sp. nov. Genitalia slide MWM 8782 . Israel, 10 km SO Tel Aviv, Highway Jerusalem – Tel Aviv [Coastal Plain, Nahal Ayalon], larva [early] October, e. l. Dec. 2002, leg. G. MÜLLER [& V. KRAVCHENKO]. **Fig. 17.** *Olepa schleini* sp. nov. Genitalia slide MWM 8292 . Israel, 10 km SO Tel Aviv, Highway Jerusalem – Tel Aviv [Coastal Plain, Nahal Ayalon], larva [early] October, e.l. Dec. 2002, leg. G. MÜLLER [& V. KRAVCHENKO]. **Fig. 18.** *Olepa ricini* (FABRICIUS, 1775). Genitalia slide MWM 8514 . S/O Indien, Madurai, e. p. 3. 4. 1986, leg. KREUZER; coll. G. KREUZER, MWM. **Fig. 19.** *Olepa ricini* (FABRICIUS, 1775). Genitalia slide

MWM 8515 (aedeagus inverted). S/O Indien, Madurai, e. p. 10. 4. 1986, leg. KREUZER; coll. G. KREUZER, MWM. **Fig. 20.** *Olepa ricini* (FABRICIUS, 1775). Genitalia slide GO 922 after ORHANT, 1986, fig. 20. **Fig. 21.** *Olepa ricini* (FABRICIUS, 1775). Genitalia slide MWM 8346 . S/O Indien, Madurai, e. p. 4. 12. 1986, leg. KREUZER; coll. G. KREUZER, MWM. **Fig. 22.** *Olepa toulgoeti* ORHANT, 1986. Genitalia slide MWM 8295 (aedeagus inverted). S. India, Kerala, Neyyar Dam, 135 m, 40 km NE Trivandrum, 8°32' N. L. 77°05' E. B., cultivated land, 4. iv. 1997, leg. SCHINTLMEISTER & Sinjaev, MWM. **Fig. 23.** *Olepa toulgoeti* ORHANT, 1986. Genitalia slide MWM 8510 . Indien mer. Tamil Nadu, Vercaud, nw Salem, 1200 m, 16. vii. 1990, leg. Dr. W. THOMAS, MWM. **Fig. 24.** *Olepa toulgoeti* ORHANT, 1986. Genitalia slide MWM 8512 . Indien mer. Tamil Nadu, Vercaud, nw Salem, 1200 m, 16. ii. 1990, leg. Dr. W. THOMAS, MWM. **Fig. 25.** *Olepa schleini* sp. nov. Genitalia slide MWM 8528 . Israel, Coastal Plain, Nahal Ayalon, south of Tel Aviv, mid-October 2000 Lf., leg. G. MÜLLER & V. KRAVCHENKO. **Fig. 26.** *Olepa schleini* sp. nov. Genitalia slide MWM 8294 . Israel, 10 km SO Tel Aviv, Highway Jerusalem – Tel Aviv [Coastal Plain, Nahal Ayalon], larva [early] October, e.l. Dec. 2002, leg. G. MÜLLER [& V. KRAVCHENKO]. **Fig. 27.** *Olepa schleini* sp. nov. Genitalia slide MWM 8293 . Israel, 10 km SO Tel Aviv, Highway Jerusalem – Tel Aviv [Coastal Plain, Nahal Ayalon], larva [early] October, e.l. Dec. 2002, leg. G. MÜLLER [& V. KRAVCHENKO]. **Fig. 28.** *Olepa ricini* (FABRICIUS, 1775). Genitalia slide MWM 8347 . SE. India, Madurai, e. p. 16. 4. 1986, leg. KREUZER, MWM. **Fig. 29.** *Olepa ricini* (FABRICIUS, 1775). Genitalia slide GO 1092 after Orhant, 1986, fig. 51 (inverted). **Fig. 30.** *Olepa toulgoeti* ORHANT, 1986. Genitalia slide MWM 8341 . S. India, Kerala, Theimala n. Shencottah, 70 km N Trivandrum, 150 m, 4. iv. 1997, leg. SCHINTLMEISTER & SINIAEV, MWM.

Authors' addresses:

Dipl.-Kfm. Thomas J. WITT
Museum Witt, Tengstraße 33
D-80796 München, Germany
e-mail: witt-thomas@t-online.de

Dr. Günter MÜLLER
Department of Parasitology
Kuvin Centre for the Study of Infectious and Tropical Diseases
The Hebrew University – Hadassah-Medical School
Jerusalem, Israel
e-mail: Muller@md.huji.ac.il

Dr. Vasiliy D. KRAVCHENKO
Department of Zoology
Tel Aviv University
Tel Aviv, 69978 Israel;
e-mail: vasiliy@post.tau.ac.il

Michael A. MILLER
Zoologische Staatssammlung München
Münchhausenstraße 21
D-81247 München, Germany;
e-mail: miller@zsm.mwn.de

Dr. Axel HAUSMANN
Zoologische Staatssammlung München
Münchhausenstraße 21
D-81247 München, Germany
e-mail: Axel.Hausmann@zsm.mwn.de

Dr. Wolfgang SPEIDEL
Museum Witt
Tengstraße 33
D-80796 München, Germany
e-mail: speidel-wolfgang@web.de