A new species of *Amicta* Heylaerts, 1881 from the south of Iran (Psychidae)

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Zusammenfassung. *Amicta sericata* sp.n. wird beschrieben, abgebildet und ihr Status diskutiert. Sie lebt an verschiedenen Büschen und Sträuchern im klimatisch sehr unwirtlichen Sandheidegebiet der Provinz Fars im Süden des Zagros Gebirges im Iran. Die Raupen leben in einem gegen die grossen Temperaturschwankungen im Lebensraum auffallend gut isolierten Sack.

Abstract. *Amicta sericata* sp.n. is described, illustrated and its systematic status is discussed. It feeds on several species of bushes and shrubs in a climatically most inhospitable sand heath or desert of the Fars province, in the south of the Zagros mountain chain of Iran. The larvae live in a bag that is exceptionally well insulated against the high temperature variations of the area.

Résumé. Les auteurs décrivent, illustrent et discutent de la position systématique d'*Amicta sericata* sp.n.. L'espèce vit aux dépens de plusieurs arbrisseaux et arbustes dans un milieu désertique très inhospitalier de la province de Fars, au sud des Monts Zagros, en Iran. Les larves construisent un fourreau les isolant parfaitement des grandes variations de température ambiantes.

K e y w o r d s . Lepidoptera, Psychidae, *Amicta sericata*, Iran, Fars Province, host plants

Introduction

In the eastern part of Fars province, south of Iran, HA and Seyed Asghar Alehoseni discovered an unknown species of *Amicta* Heylaerts, 1881 feeding on several species of bushes and shrubs. The host plants are desert adapted with needle or fleshy like leaves; they are native to western Asia and distributed through Afghanistan, the Arabian Peninsula, Iran, and Pakistan (temperate and tropical regions) (Wiersema & Leon 2004). In the literature, no Psychidae species have previously been reported from these plants. The adult males were recognized to belong to the genus *Amicta* Heylaerts, 1881 (Oiketicinae Herrich-Schäffer, 1850: Acanthopsychini Tutt, 1900). However, the larvae do not build the known square-shaped bags typical of *Amicta* species, but bags with a circular cross section and a thick silk coating on the outside.
In the same area there were also bags of an *Oiketicoides* Heylaerts, 1881 (species not identified) with a circular cross section and with plant material arranged lengthwise, and bags of *Amicta murina* Klug, 1832, which have a square-shaped cross section.

Material and Methods

All the material was collected by HA and Seyed Asghar Alehoseni on June 14, 2000, June 1–4, 2004, and between June 3 and mid September 2005, in Qatrouyeh, Neyriz, Fars Province, Iran. This locality averages 1640 meters above sea level and its coordinates are 54°42'E and 29°8'N. A smaller population of the species was also found at Abadeh, in the northwestern part of Fars Province at 1580 m. Most bags still contained larvae

and some had started to fix their bags to branches and were preparing for pupation. The bags with active larvae were kept in cages and the larvae were fed with *Artemisia* sp. and *Zygophyllum* sp. until pupation.

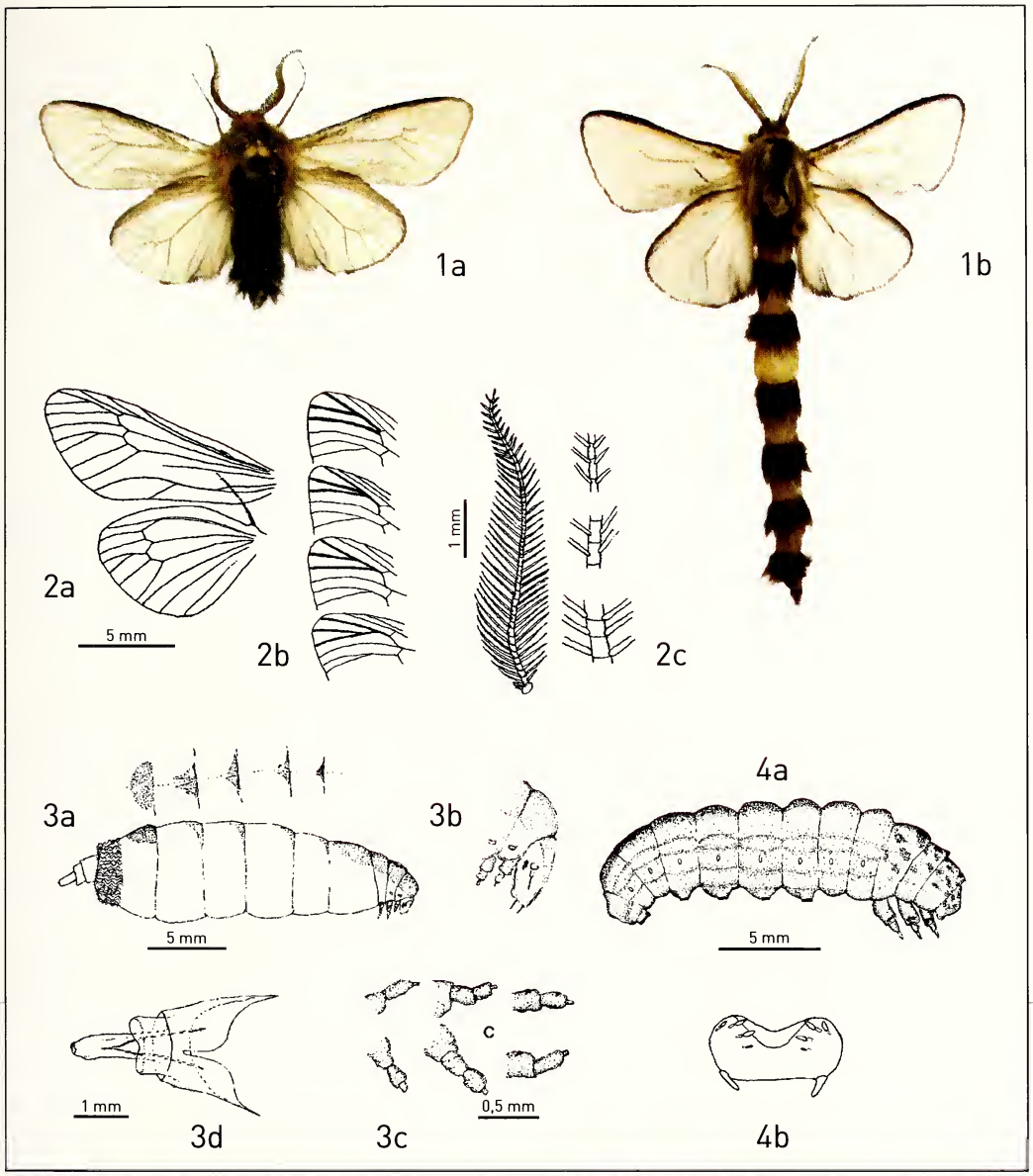
The male type material is pinned and mounted. The wingless females were taken out of their bags and preserved in 70% alcohol. All specimens and bags are labelled with the date and location on a white label and with the name on a red label.

***Amicta sericata* sp. n.** **Figs. 1–4, 5a, b, d, 6, 7a, b, 8a, 9a, 10**

Material. Holotype: ♂, **Iran**, Qatrouyeh, Neyriz, Fars province, 1640 m, 5.ix.2004, ex larva, 29°8'N 54°42'E, coll. Naturmuseum Luzern (together with the respective bag). – Paratypes: same data, but 3♂ 1.ix.2000; 1♂ 25.viii., 2♂ 31.viii, 15♀ 17.–20.ix.2004, ex larva or ex pupa with bags, 7 larvae 18.vi. and 25 additional bags as well as 40♂ 29.viii., 20♀ 29.viii., 9♀ 10.–16.ix. 2005, and 60 additional bags; deposited in the following collections: Hayk Mirzayans Insect Museum, Insect Taxonomy Research Department, Plant Pest & Disease Research Institute, Teheran, Iran (HMIM); Natural Resources Insect Museum, Plant Protection Department, Research Center for Agriculture and Natural Resources of Fars Province, Shiraz, Iran (NRIM); The Natural History Museum, London; Naturmuseum Luzern, Switzerland; Museum d'Histoire Naturelle, Genève, Switzerland; Collection Willi Sauter, Illnau, Switzerland; Museum für Tierkunde, Dresden, Germany; Naturhistorisches Museum, Wien, Austria; Collection Erwin Hauser, Wolfern, Austria; Collection Thomas Sobczyk, Hoyerswerda, Germany; Collection R. & P. Hättenschwiler, Uster, Switzerland.

Diagnosis. Male with a strong structure, all wings transparent. Anal veins in forewings cup separate not merging with an1, sc and rr in hindwings fused over large part of the wing. Body with dark brown to black hairs, thorax mixed with whitish hairs. Male genitalia long and slender saccus short, tegumen trapezoid, phallus longer than the whole genitalia. Bag round in cross section coated with a thick layer of gray silk.

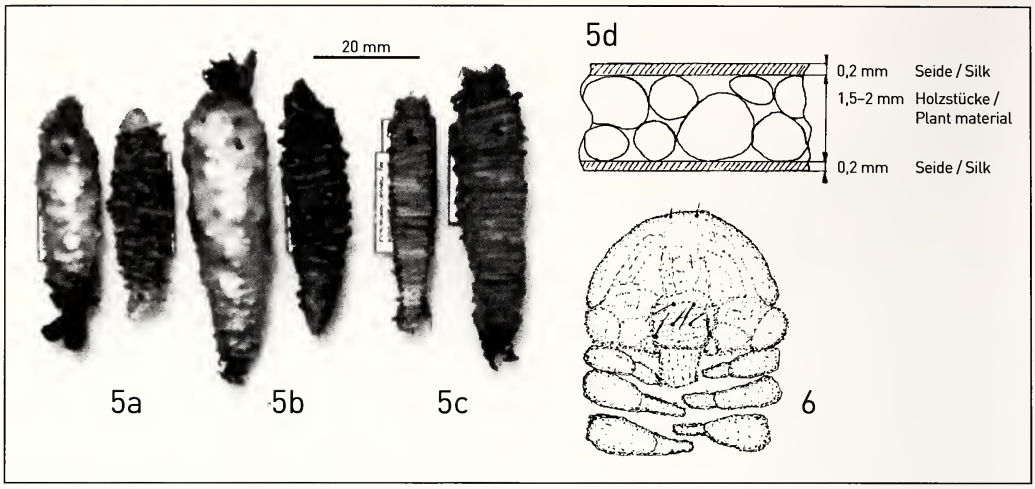
Description. Male. Wing expanse: 25–28 mm, average 26.6 mm (n = 32); forewings wide, with rounded apex (Fig. 1a), with 10 veins off discoidal cell (Fig. 2a); r3, r4, and r5 extremely variable, normally with one stem and divided in various ways, can differ on left and right wings of same specimen (Fig. 2b); m2+m3 stalked. Wing scales hair-like, pointed, short, class 1 (Sauter & Hättenschwiler 1999), dark brown, mixed with longer, whitish scales, loosely attached and set widely separated from one another (therefore wings appear light colored), easily lost with first wing movements (therefore wings become naked and fully transparent). All wing margins with dark brown, nearly black scales or hairs remaining attached during flight; narrow, hair-like scales located on front and rear margins and wide, toothed scales on apex and outer margin. Hindwing with 6 veins off discoidal cell, m2+m3 stalked, rr fused with sc over a large part of wing; scales and fringes as on forewing. Antenna (Fig. 2c) with 40–45 segments; except for 2–3 basal segments, all segments pectinated with sensory hairs and few individual scales; on basal flagellomeres pectinations arise from base of flagellomeres, in middle of antenna arising from middle of flagellomeres, and near apex arising from apex of flagellomeres. Large, round eyes as large as height of head itself, distance between eyes as long as half eye diameter. Ocelli absent. Labial palps strongly reduced. Face with long, brown hair tuft; forehead and thorax with mixture of brown and gray hairs. Foreleg longest, with long epiphysis; mid and hind legs without spurs or only very small apical spurs; all legs coated with appressed dark hairs. Abdomen dark brown to black.



Figs. 1–4. *Amicta sericata* sp. n. **1a.** Freshly emerged male, **b.** Male with abdomen extended for mating (photos by H. Alemansoor). **2.** Characters of wings and antenna, ♂. **a.** Shape and venation of fore- and hindwing. **b.** Forewing variation in veins r3–5. **c.** Antenna with enlarged details on the right. **3.** Female. **a.** Lateral view. **b.** Head enlarged. **c.** Legs. **d.** Genitalia, ventral view. **4.** Larva. **a.** Lateral view. **b.** Ventral side of labrum.

Genitalia (Fig. 8a) long and slender; saccus short; tegumen trapezoid; valves inserted into vinculum with moveable joint; phallus very long, longer than whole genitalia.

Female. Vermiform, thin skinned, whitish to faded yellow, or with pastel greenish shade, 20–24 mm long, 5–6 mm in diameter (n = 20) (Figs. 3a, b). Ocelli missing. With 3-segmented, unfunctional legs (Fig. 3c). Antennae represented by small studs;



Figs. 5–6. 5. Bags of *Amicta* species. **a, b.** *A. sericata* sp. n. with silk coating removed on the right (a: ♂, b: ♀). **c.** *A. murina*, male on the left, female on the right (photo by S. Parpan). **d.** Cross section of wall of *A. sericata* sp. n. bag showing the three layers: silk – wood – silk. **Fig. 6.** *A. sericata* sp. n. head plate of female pupa (only the leg sheaths can be recognized clearly).

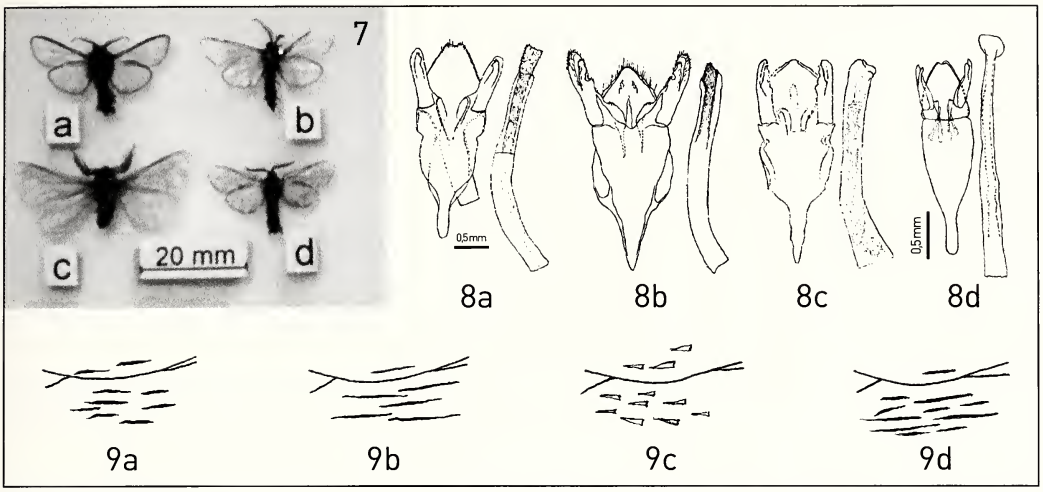
eyes by few dark dots. Head, first three thoracic segments and first abdominal segment more thickly sclerotized dorsally; following abdominal segments often with small dark plates larger on each subsequent segment until segment 6; segment 7 with complete circle of brown hairs. Genitalia (Fig. 3d) strongly sclerotized; ovipositor long, reaching twice its diameter.

Egg. Slightly oval, without clearly visible structures, whitish when fresh, but gradually changing to dark gray during development.

Larva. Prior to pupation, 20–30 mm long; whole body light gray-brown; head and thorax with dorsal and lateral, irregularly arranged, dark brown markings (Fig. 4a); arrangement of setae on ventral side of labrum as shown on fig. 4b.

Bag. Male 32–38 mm long, round in cross section, 10–12 mm in diameter; female 35–48 mm long with diameter of 11–16 mm (Fig. 5a, b), round, slightly tapered to nearly cylindrical. Foreign matter attached to bag consisting of short, thin sections of branches of food plant cut to proper length by larva and attached to front end of bag. Outside of bag coated with layer of silver-gray silk. Wall of bag composed of three layers (Fig. 5d): First layer inside silk cushion of approx. 0.2 mm thickness; second layer of foreign plant material for approx. 1.5–2 mm and third layer silk coating of another 0.2 mm thickness.

Pupa. Male pupa 13–16 mm long (average 14.9 mm), 3.5-4.5 mm in diameter (average 4.1 mm, n = 59); female 16–21 mm long, 4.5–6 mm in diameter. Dark brown prior to hatching; empty exuvia light brown. Head plate with 4 pairs of bristles, one of them near neck. Female head plate with individual sheaths not clearly demarcated only leg sheaths can clearly be recognized (Fig. 6). Abdominal segments and intersegmental membranes in both sexes equipped with thorns allowing pupa to move



Figs. 7–9. 7–8. Males of *Amicta* and *Hyalopteronia* species. **7.** Adults. **a, b.** *A. sericata* sp. n. (a: freshly emerged ♂; b: worn ♂ after mating flight). **c.** *A. murina*, the abdomen (partly removed) is lighter in color. **d.** *A. quadrangularis* (photo by S. Parpan). **8.** Genitalia. **a.** *A. sericata* sp. n. **b.** *A. murina* (from Dierl 1964). **c.** *A. quadrangularis* (from Bourgogne 1949). **d.** *Hyalopteronia davarica* (from Solyanikov 2002). **9.** Hairs and scales of forewing anal area of. **a.** *A. sericata* sp.n. **b.** *A. murina*. **c.** *A. quadrangularis*. **d.** *Hyalopteronia davarica*.

forwards or backwards within bag or out of it. Long rows of thorns directed forward on anterior edges of inter-segmental membranes 1–2, 2–3, 3–4, and 4–5 allowing to move backward. Dorsal plate of segment 5 with row of 20–23 strong thorns, segment 6 with row of 12–15 thorns, and segment 7 with 4–6 thorns all directed backward and serving to move forward.

Life history. L a r v a . The young larvae hatch from the eggs after 2–4 weeks in their mother's exuvia, but hurry to get out of the bag. Their first action is to build a miniature bag with silk and often with plant material taken from the mother's bag. During their whole life the larvae will be busy to maintain, repair, and enlarge their bag to accommodate their increasing size, but they will never leave it. The bag must be kept long enough and wide enough so that the larva can turn around within it. To enlarge the bag suitable sticks or branches are cut to the required length with the mandibles and fixed with silk at the edge of the front opening. One stick is fixed beside the other until the bag is long and wide enough for the growing larva. The rear end, which becomes too narrow, is bitten off and dropped. The new end is carefully equipped with an exit that closes by itself. This is done with silk threads under tension which, by virtue of their elasticity, pull the walls of the soft end together and keep the opening closed to prevent enemies from entering. From the inside, however, the larva can push it open easily to dispose of the excrements. Early in their life the larvae start spinning a solid silken coating all over the plant material of the bag. The larva stretches out from the front opening to cover the anterior half of the bag, the other half is reached through the rear opening. The silk is applied crosswise in many layers on top of the layer of wooden fragments. The three layers of the wall of the bag and the trapped air between the wooden pieces together perfectly isolate the insect against extreme weather conditions,

Tab. 1. Field data on percentages of attack or parasitism on bags of *A. sericata* sp. n. on two separate dates.

	Spiders	Torymidae	Chalcididae	Tachinidae	Totals
14.viii.2005	36%	5%	1.8%	13.85%	56.65%
27.viii.2005	9%	28.9%	0%	25.7%	63.6%

but also offer strong mechanical protection. The smaller rear opening is used to dispose of the excrements, the males hatch through this opening, and the females use it for mating. The larvae of some species in the genera *Ptilocephala* Rambur, 1866 and *Phalacropterix* Hübner, 1825 also cover their bags with some layers of silk prior to pupation, but by far not as thick as in *A. sericata* sp.n. Could it be that due to the very large variations between the day- and night-time temperatures, that the species developed the thick coating as additional insulation?

While rearing *A. sericata* sp. n., parasitoid Ichneumonidae and Chalcididae were obtained as well as Tachinidae of the genus *Chetogena* Rondani and *Nealsomyia rufella* (Bezzi) (det. by H. P. Tschorsnig and B. Merz). A remarkable number of larvae were killed by the fungus *Aspergillus parasiticus* Speare (det. by S. Keller and S. Balazy). Apparently this fungus is not as dominant in the natural habitat of *A. sericata* sp.n. than in our lab colonies. Observations in the field also showed that spiders were waiting to ambush larvae at the front end of the bag. Whenever these larvae wanted to feed, the spiders attacked them. HA also observed spiders in bags sucking on larvae and only leaving their skin. These spiders of the family Heteropodidae, genus *Micromata* (det. J. Walter and U. Kloter) appear to be a key mortality factor for *A. sericata* sp.n. On August 14, 2005 HA collected 136 bags and on August 27 166 others in the same area. These bags were attacked or parasitized in the proportions shown on Tab. 1. These observations based on a total of 302 bags cannot tell us whether or not these percentages are representative for the whole population, which is spread out over a wide area. Some of the relatively large population of this big species also is eaten by some local birds, which manage to break open the hard bags, but bags with mechanical damages that could be made by a strong-billed beak were found only occasionally. However, it appears that the *A. sericata* population studied lives in a balanced equilibrium with its parasitoids and predators.

P u p a . In summer, normally between July and early August, the bag is tightly attached at the front end with many silk threads to a branch or stem of the food plant, often the one on which the larva spent its whole development. Then, the bowels are emptied and the male molts to a pre-pupa. The female turns around, head towards the rear end, and directly pupates. After a few days the male pre-pupa also turns around towards the rear opening. Without having taken any food it finally pupates. Depending on temperature the adult moth will be ready for hatching after 2–3 weeks.

A d u l t . Mating occurs early at night. The females break open the head plate of the exuvia and move one quarter to one third out of the exuvia; while in this position within the still closed bag the females call the males with their pheromones which penetrate through the bag. The males hatch at sundown or a little later. Prior to hatching the male

Fig. 10. The type locality of *A. sericata* sp. n. in Qatrouyeh, Fars province (photo by H. Alemansoor).

pupa moves about halfway out of the bag by bending and stretching with the help of the dorsal thorns of its segments 5–7. Then, the head plate of the pupa is pushed open and the moth crawls out. After about a quarter to half an hour the wings are expanded and dried, and as soon as female pheromones reach a male, it flies toward the source of the scent. Upon reaching the female bag the male opens the rear entrance of the bag by pushing its abdomen (Fig. 1b) through the opening that is still closed by the telescopic abdomen to reach the genitalia of the attracting female. Mating only takes a few minutes. Immediately after, the female begins to lay her 300–400 eggs into the pupal exuvia and rubs off her abdominal hairs to place them between the eggs for cushioning and insulation. When finished, the female remains like a plug at the opening of the exuvia and slowly dies. The sex ratio is well balanced.

Seasonal development. The mating season is late August to mid September, somewhat depending on the altitude. There is one generation per year. In winter the larvae do not feed and the bags are strongly affixed to branches of the food plants or other solid material.

Habitat. The species is mainly known from a sandy, desert-like area with bushes, shrubs, and sparse grass in the hills and mountains of the south west of Iran, Fars province, 54°42'E / 29°8'N between 600 to 2800 meters above sea level (Fig. 10). The area experiences high climatic changes. The 16 year summer day averages are 25.9 °C (June) and 27.6 °C (July) with highs over 38 °C, but with cool nights of only 10–12 °C; in winter temperatures drop below –5 °C. The annual rainfall varies between 100 to 300 mm only. The rains mainly come between December and March, mainly in two or three downpours, thus washing the soil away.

The bags with feeding larvae of *A. sericata* sp. n. were found on the following local plants: *Zygophyllum atriplicoides* F.E.L. v. Fischer & C.A. Meyer, *Artemisia sieberi* W.S.J.G. v. Besser, *Pteropyrum olivieri* H.F. Conte de Jaubert & E. Spach, *Noaea mucronata* (P. Forsskal) P.F.A. Ascherson, *Heliotropium aucheri* A.P. de Candolle, *Ephedra* cf. *strobilacea* Bunge ex Lehmann, and *Alhagi persarum* P.E. Boissier &. F.A. Buhse (det. by Ahmad Hatami). In the locality goats and sheep graze the sparse

Tab. 2. Comparison of some characters of the Psychidae species found at the type locality of *A. sericata* and that look similar.

	Wing expanse	Mating season	Eyes interocular distance	Body color	Male genitalia (Fig. 8)	Scales on forewing (Fig. 9)
Amicta sericata	25–28 mm	mid Aug. – mid Sept.	large, as high as head, distance, 0.5 × eye diameter	Abdomen dark, thorax gray to light gray	tegumen notched (Fig. 8a)	Anal area short, dark hairs, class 1–2
Amicta murina	27–32 mm	mid Aug. – mid Sept.	large, as high as head, distance, 0.5 × eye diameter	Abdomen and head light yellow-gray, forehead dark-brown	Tegumen rounded (Fig. 8b)	Whole wing yellow-gray with loosely scattered, fine, long hairs, class 1
Amicta quadrangularis	23 mm approx	mid Aug. – mid Sept.	small, less than height of head, dist. 1.3 × eye diameter	Abdomen dark, thorax with some long silver hairs	Tegumen rounded (Fig. 8c)	Anal area with wide, short scales, class 3–5, mostly with two tips
Hyalopteronia davarica	26 mm approx.	April	large, nearly as high as head, distance 0.8 × eye diameter	Abdomen dark brown, thorax with some long, light brown hairs	Structure different (Fig. 8d)	Anal area with long and short, narrow scales mixed

grasses and bushes. Bags of *Amicta murina* (Klug, 1832) and of the genus *Oiketicoides* (species not identified yet) were also found at this locality, but in both cases their numbers made just a fraction of those of *A. sericata* sp.n.

Derivatio nominis. The name derives from the silk coating that the larva spins over the layer of wooden fragments on its case: *Serica* = silk, sericatus = "dressed in silk." to match with the genus *Amicta sericata* sp. n.

Discussion

The genus *Amicta* Heylaerts, 1881 was based on forewing venation and bag characters. Later, Jean Bourgogne (1949) made detailed studies of the genus and appended the description with three important characters: (1) forewing anal venation (Fig. 2a) (forewings cup separate not merging with an1, sc and rr in hindwings fused over large part), (2) features of the male genitalia (Fig. 8), and (3) cross section of bag (Fig. 5) (bag square shape in cross section no silk coating). *A. sericata* sp. n. matches the type species of *Amicta* for characters 1 and 2, but it builds an entirely different bag with a design that is not known in other species of the Acanthopsychini. Therefore, *A. sericata* sp. n. is here only placed conditionally in the genus *Amicta.*

The type of the genus, *A. quadrangularis* (Christoph, 1873), along with the largest species, *A. murina*, are from the Near East and known from Iran (in coll. Hättenschwiler), but they were often confused. Under *A. quadrangularis* Staudinger (1899) described

two forms that vary in hair color of the male abdomen. These are form *nigrescens*, with black abdominal hairs, and form *albescens*. However, Dierl (1964) stated that form *albescens* is synonym with *A. murina*. According to the descriptions these forms build square shaped bags. Therefore, *A. sericata* sp. n., which also has a dark haired abdomen, can not be confused with form *nigrescens*. It is no problem to determine the females because they never leave the bag. The males (Fig.7) can be distinguished by the features mentioned in Tab. 2.

Solyanikov (2002) described a new genus and a new species, *Hyalopteronia davarica*, from Angorchan, southern Iran. This taxon is known by five adult males only, which, at first glance look very much like *A. sericata*. However, *H. davorica* flies early April (*A. sericata* from late August to mid September), it has nine veins on the forewing (*A. sericata* has 10 veins off the discoidal cell), and there are several differences in the structure of the genitalia (Fig. 8d).

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