

Description of a new species of *Histiostoma* KRAMER, 1876
(Acari: Histiostomatidae)
phoretic on the solitary bee
Halictus sexcinctus (FABRICIUS, 1775)
(Hymenoptera: Apidae: Halictinae)*

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Summary

Histiostoma halicticola sp. n. (Acari: Histiostomatidae) is described from its deutonymphal stage phoretic on a solitary bee, *Halictus sexcinctus* (F.) (Hymenoptera: Apidae: Halictinae). The mites were found on male and female bees collected in the "Döberitzer Heide" natural reserve close to Berlin, Germany. The deutonymphs use specific transportation sites on the bees. These are of different structure in male and female bees, respectively. A true acarinarium has been observed only in the female bee. The structure and the function of the deutonymphal organs called "conoides" are re-examined and discussed.

Key words: Acari, Histiostomatidae, new species, phoresy, bees, Germany.

Zusammenfassung

Histiostoma halicticola (Acari: Histiostomatidae) wird anhand ihrer Deutonymphen beschrieben, die bei der solitären Biene *Halictus sexcinctus* (F.) (Hymenoptera: Apidae: Halictinae) phoretisch sind. Die Milben wurden an männlichen und weiblichen Bienen aus dem Naturschutzgebiet "Döberitzer Heide" bei Berlin (Deutschland) gefunden. Die Deutonymphen nutzen spezielle Transportplätze (Acarinarium) die sich bei männlichen und weiblichen Bienen unterscheiden. Die Struktur und Funktion der deutonymphen Organe der sogenannten "Conoiden", wurde untersucht und diskutiert.

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Résumé

Histiostoma halicticola sp. n. est décrite d'après son stade deutonymphal, phorétique sur une abeille solitaire, *Halictus sexcinctus* (F.) (Hymenoptera: Apidae: Halictinae). Ces acariens étaient attachés aux abeilles, mâles et femelles, récoltées dans la réserve naturelle de "Döberitzer Heide", près de Berlin, Allemagne. Les deutonymphes utilisent des sites de fixation spécialisés (acarinaria). Les abeilles mâles et femelles ont des sites de fixation différents. Seule l'abeille femelle possède un acarinarium. La structure et la fonction des organes de la deutonymphe appelés "conoides" sont réexaminées et discutées.

Introduction

During investigations on the biology of the ground-nesting solitary bee *Halictus sexcinctus* in the "Döberitzer Heide" natural reserve, close to Berlin (Germany), numerous deutonymphs (= hypopi) of a hitherto undescribed species of the genus *Histiostoma* KRAMER (Histiostomatidae) were found by the junior author on the bees. Our attempts to find the other stages (adults, tritonymph, protonymph and larva) of the mites failed as yet, however. The purpose of this paper is to describe the new mite species and summarize what is known about its ecology. Moreover, the structure and the function of the deutonymphal organs called "conoides" are discussed. All the measurements are in micrometers (μm).

Family Histiostomatidae BERLESE, 1897

Genus *Histiostoma* KRAMER, 1876

Histiostoma halicticola sp. n.

This new species is known only from the deutonymphal stage.

Deutonymph holotype (hypopus) (Figs 1-15) : *Idiosoma* 245 long and 165 wide. Length and width of 6 paratypes: 250 × 166; 261 × 180; 280 × 190; 290 × 198; 310 × 204; 315 × 210. *Dorsum* with two rather poorly sclerotized shields. Propodonal shield with a faint reticulate pattern consisting of polyedric elongated and slightly raised platelets. Hysteronotal shield with a reticulate pattern poorly developed and restricted to its anterior third, the rest of the shield is uniformly punctate without lines. Sejugal furrow well developed. Anterior border of hysteronotum distinctly crenelated. *Chaetotaxy*: *vi*, *ve*, *scx* and *d5* are lacking; *sci* and *sce* very short (3-5), situated on a transverse very slightly convex line; *d1*, *d2* and *d3* 3 to 4 long, *d4* 10, *l1* to *l4* 4 to 6, *l5* relatively thick and 12 long. Oil glands each represented by a small ring between setae *l2* and *l3*. *Venter*: Palposoma large, trapezoidal, its anterior border 12 wide, its posterior border 22 wide, its length 22; palposoma carries a pair of apical solenidia alpha (α) 55 long, flanked laterally and at both sides by a very short seta (palposomal seta). Sternum 42 long, epimera II fused posteriorly with epimera III, the common sclerite being fused in the midline into a short longitudinal sclerite. Suctorial plate 90 wide and 65 long, its membranous

margins striated radially, the striations of the anterior part of the plate are distinctly thicker than those more behind. Diameter of anterior movable suckers 12, of posterior fixed suckers 30. There are two pairs of *conoides*, a lateral pair (*lc*) situated almost at the same level as the posterior suckers and a paramedian pair (*pc*) situated behind the posterior suckers. *Chaetotaxy*: Setae *cxI*, *cxIII* and *gp* modified into *conoides* and similar to the *lc* and *pc*. Setae *sh* thin and short (5-10). Legs: Lengths of tarsi I-IV 78-57-72-76. In a paratype measuring 290 long and 198 wide the lengths of these tarsi are 96-66-78-85. *Chaetotaxy* and *solenidiotaxy*: see figures.

Host and locality: Holotype deutonymph from *Halictus sexcinctus*. Locality: Döberitzer Heide natural reserve, near Berlin, Germany. (July 1997). *Paratypes*: 20 deutonymphs with the same data as holotype. Holotype in the Institut royal des Sciences naturelles de Belgique. Paratypes in the same Institute and in the collections of the authors.

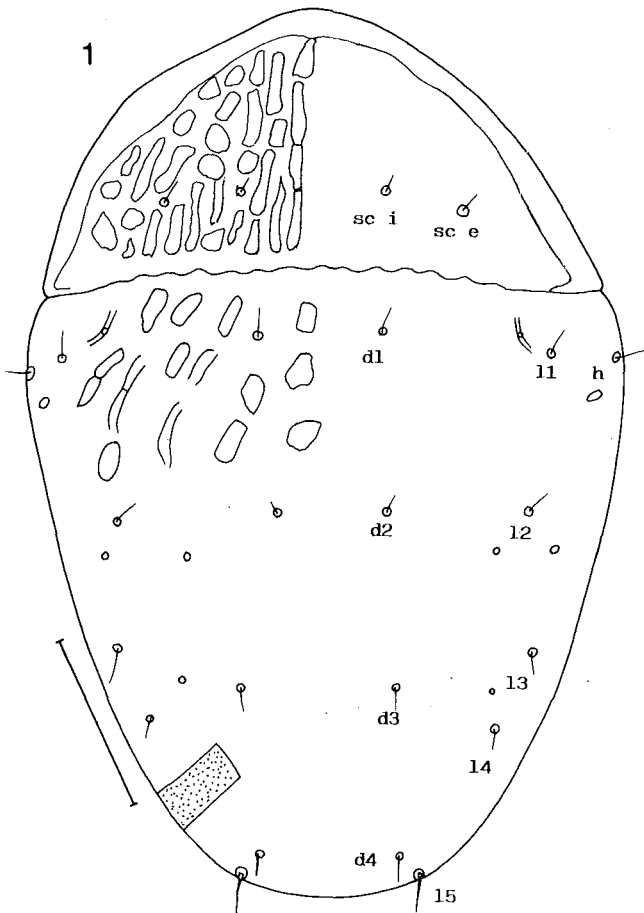
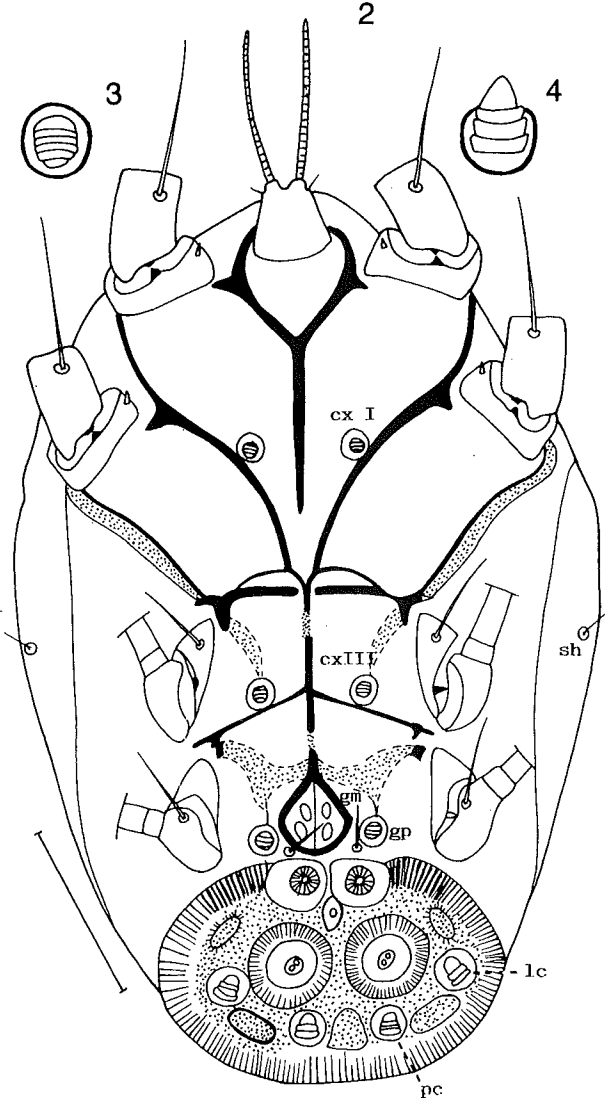


Fig. 1. *Histiotoma halicticola* sp. n. Deutonymph in dorsal view. Scale line 50µm.

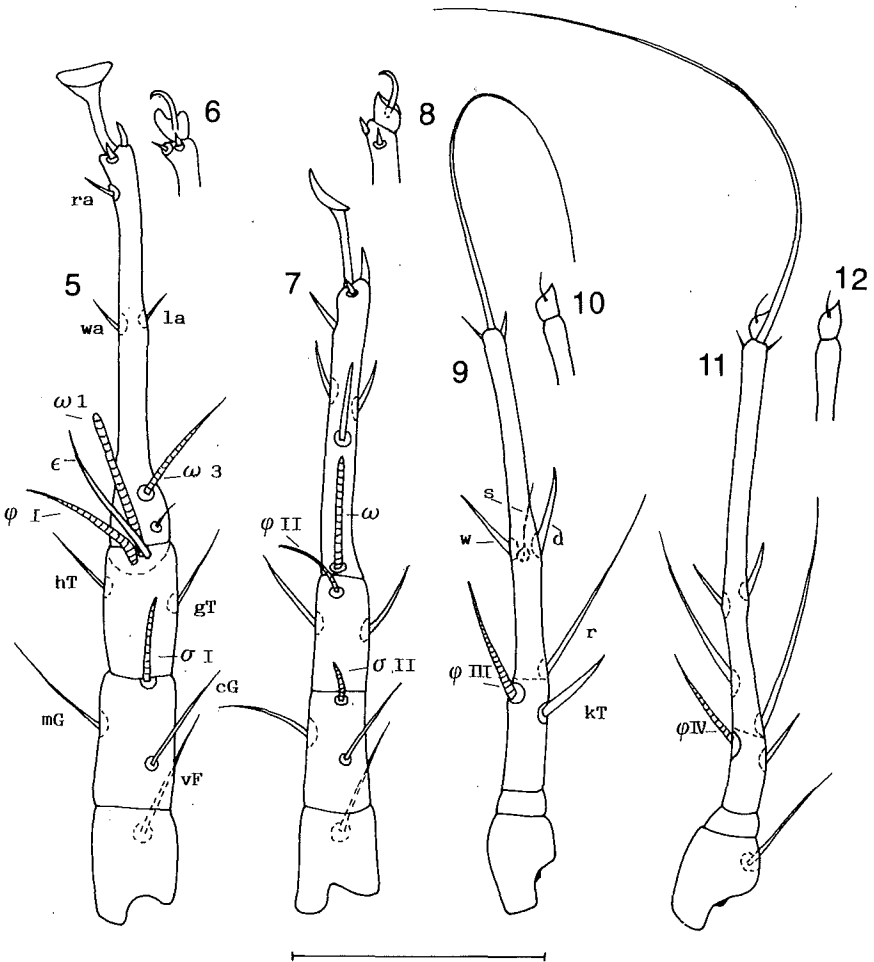
Remarks on the structure and the fonction of the "conoïdes":

FAIN (1973), in a revision of the genus *Crabrovidia* ZACHVATKIN (1941) (*Winterschmidtiiidae*) based on deutonymphs, described the "conoïdes": 2 pairs of conical soft and collapsible structures with concentric thickenings or ridges, located on the suctorial plate. One pair is situated behind the posterior suckers (paramedian conoïdes or *pc*), the other is more lateral and often outside of the posterior suckers (= lateral conoïdes or *lc*). FAIN surmised that these structures



Figs 2-4. *Histiotoma halicticola* sp. n. 2: deutonymph in ventral view; 3: collapsed conoïdes; 4: erected conoïdes. Scale line 50 μ m.

could act as elastic buffers facilitating the release of the mite when it detaches from the host. These organs could therefore be considered as releasing organs. In the present paper we depict a conoide in a collapsed condition (Fig. 3) and another in erected condition (Fig. 4). The concentric ridges of the conoides are easily visible in scanning micrograph n° 15. FAIN & BEAUCOURNU (1973, p. 519) described the deutonymph of a new genus and species of Histiostomatidae (= Anoetidae) and they noted the presence of conoides not only on the suctorial plate but also on the coxal areas. Setae *cxI*, *cxIII* and the *gp* also were modified into conoides. These organs have also been observed in other families of Astigmata (e.g. Acaridae) but always only on the



Figs 5-12. *Histiostoma halicticola* sp. n. Deutonymph. 5 and 7: Leg I and II in dorsal view; 6 and 8: Apical part of tarsi I and II in ventral view; 9 and 11: Legs III and IV in dorso-lateral view; 10 and 12: Apical part of tarsi III and IV in ventral view. Scale line 50 μ m.

deutonymphs. In the genus *Histiostoma* all the species carry 5 pairs of conoides, whilst in some other genera conoides are present only on the suctorial plate.

WOODRING & CARTER (1974), in their study of the suctorial plate of *Caloglyphus boharti* (CROSS, 1969) (Acaridae), overlooked our paper and considered these organs as discs (*d5* and *d6*), with probably a sensory function. More recently, EVANS (1992), unaware of our papers, proposed to designate the "discs" of these authors as "conoides", a term that we have used since 1973, in numerous papers.

Systematic position of Histioostoma halicticola:

H. halicticola is clearly distinguished from the other species of *Histiostoma*, and especially those described from Halictidae, by the characters given in the the following key:

**Key to the *Histiostoma* species phoretic on halictid bees
(Deutonymphs)**

1. Conoides *cxI* distinctly removed from trochanters II. Anterior margin of hysteronotum crenelated or straight 2
- Conoides *cxI* very close to trochanters II. Anterior border of hysteronotum straight 3
2. Anterior suckers much smaller (diameter 12) than posterior ones (diameter 30). Anterior border of hysteronotum crenelated. Antero-dorsal shield completely covered with a faint reticulated pattern formed of polygonal or elongate slightly raised platelets. Palposoma trapezoidal with posterior border almost twice as wide as the anterior border. Body larger: 245-315 long, 165-210 wide. Host: *Halictus sexcinctus* (F.). Germany
..... *H. halicticola* sp. n.
- Anterior and posterior suckers equal or subequal in diameter. Anterior border of hysteronotum not crenelated. Antero-dorsal shield with a faint pattern in its lateral regions, the median area punctate. Palposoma smaller, only slightly widened in its posterior half. Body smaller, idiosoma 193-202 long and 141-147 wide. Host: *Halictus holtzi* SCHULTZ, Afghanistan
..... *H. szelenyii* MAHUNKA, 1974
3. Small species: Idiosoma 170-180 long. Solenidion ωI (on tibia I) club-shaped. Dorsal shields finely punctate. Hosts: *Augochlora* spp., Costa-Rica .
..... *H. eickworti* WOODRING, 1973
- Larger species: Idiosoma 229-250 long. Solenidion ωI (on tibia I) cylindrical 4
4. Idiosoma 229-237 long and 149-158 wide. Both dorsal shields with a pattern of longitudinal sinuous lines. Palposoma only slightly trapezoidal, almost as wide as long. Host: *Halictus tatrazonianellus* SHEL. Locality ? . .
..... *H. orientalis* MAHUNKA, 1974

- Idiosoma 250 long. Antero-dorsal shield with a pattern of reticulated lines forming polygonal or rounded raised platelets. Palposoma one and an half times as wide as long. Host: *Halictus rubicundus* (CHRIST), U.S.A.
 *H. halictonida* WOODRING, 1973

Biology and distribution of the deutonymphs on the bee

The deutonymphs of *Histiostoma halicticola* sp. n. were found on males and females of the solitary ground-nesting bee, *Halictus sexcinctus*. This bee is abundant in the open, in part heathlike grassland of the former "Döberitzer Heide" military training area which is now a natural reserve (ERTELD, 1995). The mated females hibernate in the nests. In the following year, from the end of May to beginning of June, they start building new nests and begin foraging for pollen and nectar, which is stored in their nests to serve as food for the larvae. In July and August, the males and females of the new generation hatch whilst the old females die. The female offspring remains in the nest and the males leave in search of other nests. Males enter several nests to mate with newly emerged females (ERTELD, 1996). The males die in autumn while the mated females hibernate. From 15 July to 6 August, the junior author examined 22 bees (6 females and 16 males). Among them, 17 individuals carried a total of 532 deutonymphs (Table I).

The deutonymphs of *H. halicticola* attach themselves to specific sites on the bees which appear to facilitate the most successful transportation. Mites may be observed in roof tile-like aggregations at these sites. On female bees the mites are generally found in a deep setose furrow on the second tergite where they are sheltered and well protected from removal (acarinarium) (Fig. 13). This structure is not present in males. On females with more than 30 mites, some were also found on the propodaeum and in the hypoepimeral field, which show no specific sheltering structures. This suggests that the mites prefer the furrow and only accept other transportation sites when the furrow has already been occupied by other individuals.

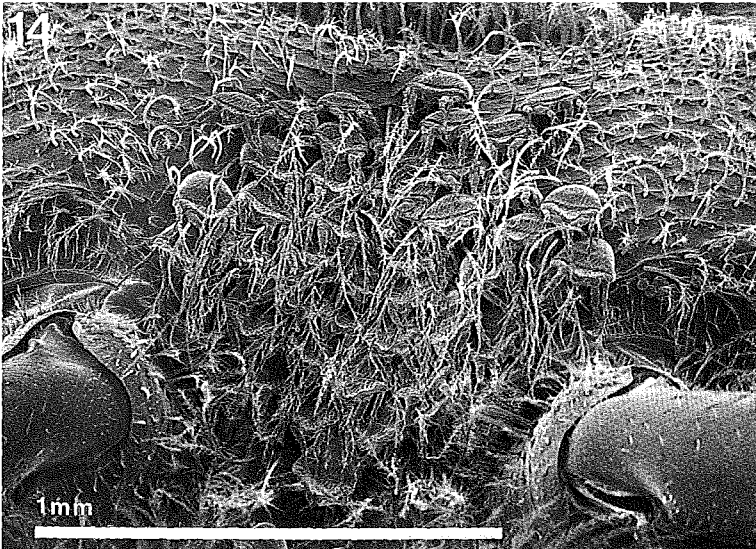
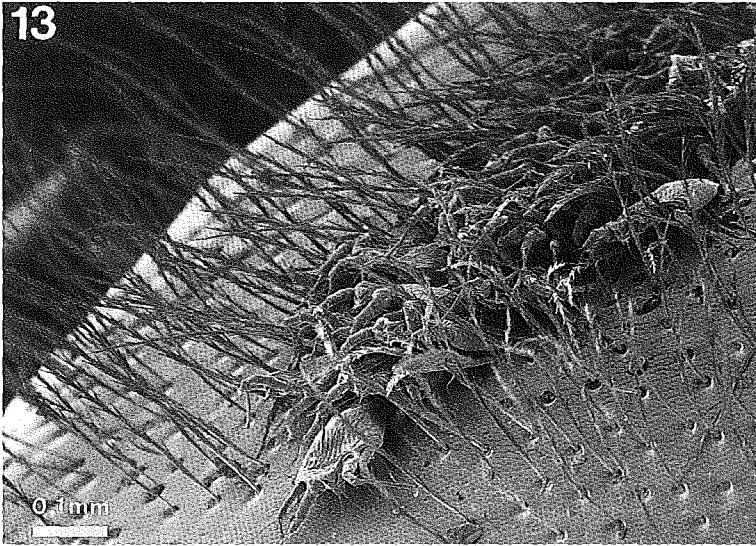
On male bees most of the mites were attached to the ventral surface of the thorax between the coxae (Fig. 14). This site is more concave and smoother in males than in females. In the absence of a setose furrow, the deutonymphs may attach to the smooth area between the coxae on which their suctional plate presumably stick (Fig. 15). This in combination with protection offered by the deep concavity, seems to provide a safe transportation site.

The phenomenon described here represents a case of phoresy facilitated by the presence of an acarinarium. Acarinaria have been described in other Hymenoptera (e.g. COOPER, 1955; KROMBEIN, 1961; MADEL, 1975; OCONNOR, 1993 see also KIONTKE, 1997).

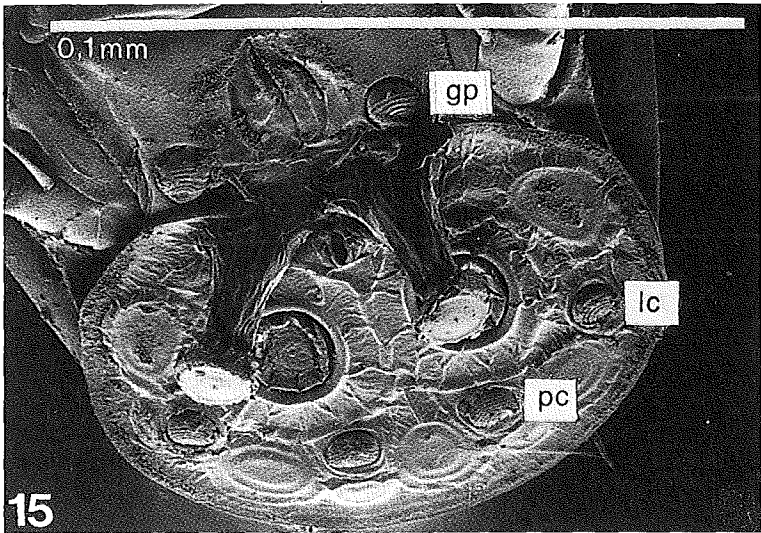
Besides *Histiostoma halicticola*, the junior author also collected two other species of mites of the families Pygmephoridae and Scutacaridae on the bees. These species are being studied separately.

Table 1. Number and attachment sites of the deutonymphs of *Histiostoma halicticola* on the bees

Date	Number of mites	Location on the bee
nesting females:		
17.VII.1997	1	ventral thorax
17.VII.1997	43	2. tergite, propodeum lateral and dorsal
06.VIII.1997	60	2. tergite, propodeum lateral and dorsal, hypopimeral fields
females dug out the nest:		
freshly emerged and unmated bee out of an closed broodcell:		
06.VIII.1997	-	
freshly emerged possibly mated out of an borrow of the nest:		
06.VIII.1997	14	2. tergite
06.VIII.1997	30	2. tergite
males:		
15.VII.1997	8	ventral thorax
15.VII.1997	9	ventral thorax
15.VII.1997	51	ventral thorax, 2. tergite
15.VII.1997	95	ventral thorax
17.VII.1997	79	ventral thorax
17.VII.1997	3	ventral thorax
17.VII.1997	-	
17.VII.1997	-	
17.VII.1997	-	
17.VII.1997	89	ventral thorax
25.VII.1997	10	ventral thorax
25.VII.1997	6	ventral thorax
25.VII.1997	12	ventral thorax
25.VII.1997	2	ventral thorax
25.VII.1997	20	ventral thorax
25.VII.1997	-	



Figs 13-15. Scanning electron micrographs of deutonymphs of *Histiotostoma halicticola* sp. n. attached to the bees; 13: deutonymphs aggregated in a deep hairy furrow on the second tergite of the female bee (forming an acarinarium). Right side of the figure is the anterior part of the bee; 14: male bee with numerous deutonymphs attached to ventral surface of thoracic segment between coxae of second legs. The anterior part of the bee is the top of the figure; 15 (see p. 56): suctorial plate of deutonymph bearing *conoidea pc* and *lc*; *conoidea gp* in front of the plate.



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References

- COOPER, K.W., 1955. - Vernal transmission of mites by wasps, and some evolutionary problems arising from the remarkable association of *Ensliniella trisetosa* with the wasp *Ancistrocerus antilope*. Biology of Eumenine wasps II. *Trans. Am. ent. Soc.* 80: 119-175.
- ERTELD, C., 1995. - Methodik und erste Ergebnisse des FU-Berlin-Forschungsprojektes "Wildbienen in der Döbritzer Heide". Beiträge zur 2. Hymenopterologen-Tagung Görlitz (1995): 19-20. Hrsg: Blank S.M. & Burger F., Eberswalde.
- ERTELD, C., 1996. - Untersuchungen zur Nistplatzwahl und Phänologie von *Halictus sexcinctus* (F.) (Hymenoptera, Apoidea, Halictidae) im Naturschutzgebiet Döbritzer Heide. Schriftenreihe des Länderinstitutes für Bienenkunde Hohen Neuendorf, Band 3: Beiträge zur 2. Wildbienen Tagung: 11-22. Hrsg: Hedtke C., Hohen Neuendorf.
- EVANS, G.O., 1992. - Principles of Acarology. C.A.B. International Wallingford. Oxon OX10 8BE UK, 563 pp.
- FAIN, A., 1973. - Notes sur les hypopes des Saprogliphidae (Acarina: Sarcopitiformes) III. Le genre *Crabrovidia* ZACHVATKIN, 1941. Description de 8 espèces nouvelles symphorétiques sur les Sphecidae (Hyménoptères). *Bull. Annl's Soc. r. belge Ent.* 109: 153-189.

- FAIN, A. & BEAUCOURNU, J.C., 1973. - Description de trois nouveaux hypopes d'Anoetidae phorétiques sur les puces de mammifères. *Acarologia* 15: 514-520.
- KIONTKE, K., 1997. - Anhalter und blinde Pasagiere - Phoresie bei Nematoden und Milben. *Sber. Ges. Naturf. Freunde Berlin* 33: 143-155.
- KROMBEIN, K.V., 1961. - Some symbiotic relationships between saproglyphid mites and solitary vespid wasps (Acarina, Saproglyphidae and Hymenoptera, Vespidae). *J. Wash. Acad. Sci.* 51: 89-93.
- MADEL, G., 1975. - Vergesellschaftung der Milbenart *Dinogamasus villosior* mit der afrikanischen Holzbiene *Xylocopa flavorufa* (Acari: Laelapidae/Hymenoptera: Xylocopidae). *Entomol. Ges.* 1: 144-150.
- MAHUNKA, S., 1974. - Beiträge zur Kenntnis der an Hymenopteren lebende Milben (Acari). II. *Folia ent. hung. (Ser. Nov.)*, 27: 99-108.
- OCONNOR, B., 1993. - The mite community associated with *Xylocopa latipes* (Hymenoptera: Anthophoridae: Xylocopinae) with description of a new type of acarinarium. *Int. J. Acarol.* 19(2): 159-166.
- WOODRING, J.P., 1973. - Four new anoetid mites associated with halictid bees (Acarina: Anoetidae. Hymenoptera: Halictidae). *J. Kans. ent. Soc.* 46: 310-327.
- WOODRING, J.P. & CARTER, S.C., 1974. - Internal and external morphology on the deutonymph of *Caloglyphus boharti* (Arachnida: Acari). *J. Morphol.*, 144: 275-296.

