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## **Identifying of Iranian species of the subgenus *Psithyrus* LEPELETIER (Hym.; Apidae, *Bombus*)**

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### **Abstract**

In this study we examined 64 specimens of Iranian *Psithyrus* subgenus collected during 2008 till 2015 from several localities mostly in North and North West of Iran. Collectively we detected 5 species: *Bombus (Psithyrus) bohemicus*, *Bombus (Psithyrus) maxillosus*, *Bombus (Psithyrus) quadricolor*, *Bombus (Psithyrus) vestalis* and *Bombus (Psithyrus) rupestris*. Key to identification and species diagnosis explained herein.

### **Zusammenfassung**

In dieser Studie werden 64 Exemplare von iranischen Kuckuckshummeln des Subgenus *Psithyrus* untersucht, die zwischen 2008 und 2015 vor allem im Norden und Nordwesten Irans an verschiedenen Orten gesammelt wurden. Dabei entdeckten wir 5 Arten, nämlich *Bombus (Psithyrus) bohemicus*, *Bombus (Psithyrus) maxillosus*, *Bombus (Psithyrus) quadricolor*, *Bombus (Psithyrus) vestalis* und *Bombus (Psithyrus) rupestris*. Dieser Beitrag gibt eine Anleitung zur Identifikation von *Bombus (Psithyrus)* und zur Unterscheidung der Arten.

### **Introduction**

Subgenus *Psithyrus* are known as an inquiline species which lacks a worker caste (ALFORD, 1975). They are a parasite on other subgenera of *Bombus* and all species are obligate social parasites ('cuckoos') in colonies of the other social *Bombus* species (reviewed by ALFORD 1975; FISHER 1987). The degree of host specificity varies among species. Females of *Psithyrus* don't collect pollen. Strictly speaking female *Psithyrus* are not queens because there is no worker caste (GOULSON 2010). The callosities: characteristic elevations on the last visible sternite of the female (St6), not found in other subgenera. Head in males of this subgenus is relatively rounded in outline comparing to elongate form in other subgenera. The hind tibia are noticeably hairy all over. For a long time *Psithyrus* has been considered as a separate genus in recognition of the distinctive behaviour of the species, as social parasites in colonies of the remaining Bombini, and in recognition of their distinctive morphology. However, most recent studies have agreed that, although *Psithyrus* is itself

very likely to be monophyletic, the remaining bumble bees without *Psithyrus* are not (PLOWRIGHT & STEPHEN 1973; OBRECHT & SCHOLL 1981; ITO 1985; WILLIAMS 1985, 1991, 1995; PAMILO et al. 1987). Based on WILLIAMS (1991), all Bumblebees subgenera, including *Psithyrus*, are recognized as a single genus *Bombus*. Also, RASMONT et al. (1995) has included the former subgenera of the former genus *Psithyrus* as separate subgenera within the genus *Bombus* (WILLIAMS 2008). Cuckoo bumblebees (subgenus *Psithyrus*) have annual life cycles; they do not find their own nest but they steal a nest from a 'true' bumblebee (GOULSON 2010). *Psithyrus* females emerge later than their hosts from hibernation, and search for young nests of other *Bombus* species. Once located, they enter the nest, kill the queen, and take over her role (GOULSON 2010). The bumblebee workers continue to forage and tend to the brood. The *Psithyrus* female lays eggs that develop into either new breeding females or males (GOULSON 2010). Since *Psithyrus* have no worker caste to influence what happens in the colony, BULMER (1983) predicted equal investment in sons and daughters by females thus leading to a numerical bias towards male offspring. Most *Psithyrus* species are able to parasitize hosts species from more than one subgenera (SAKAGAMI 1976). The invading *Psithyrus* may feed from host eggs and young larvae, but older ones are allowed to develop to workers. Nests that have been invaded produce few or no host queens or males, although workers do lay eggs and a few of the resulting male offspring may survive (FREHN & SCHWAMMBERGER 2001). In this research we examined 75 specimens, most of which collected A.M. (second author) from 2009 to 2015 and preserved in "Iranian Pollinator Insects Museum" (IPIM).

### **Material and Method**

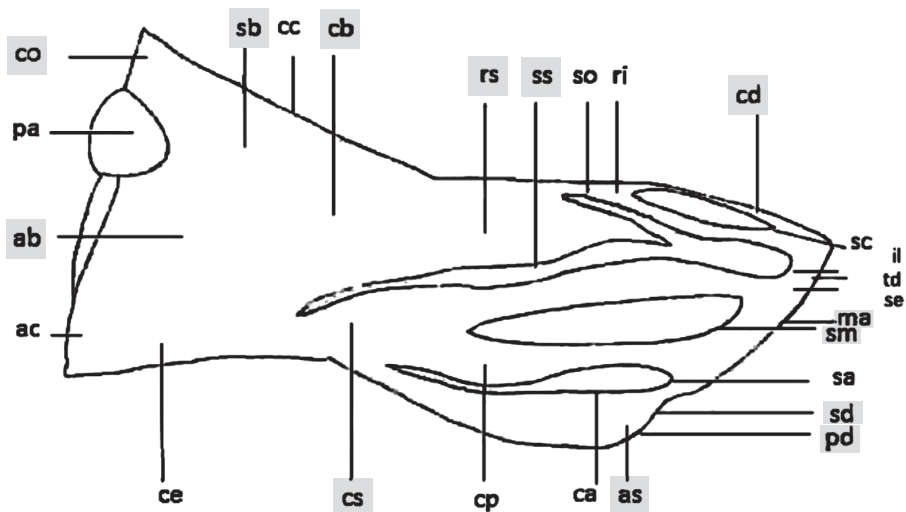
By samplings of various regions of Iran areas in spring and summer of 2009 to 2015 bees were collected from the provinces of: Ardabil, Ghazvin, Mazandaran, Tehran, etc. Following sampling bumblebees were killed with ethyl acetate and later mounting procedures were done in laboratory. Sampling locations were recorded by Garmin eTrix Hc GPS. Then, bumblebees identified to subgenera and species were deposited in the "Iranian Pollinator Insects Museum", of Plant Protection Group at the faculty of Agriculture, Yasouj University, Iran. Then final identifications and confirmations on species carried out by P.H. Williams in NHM of London.

### **Results**

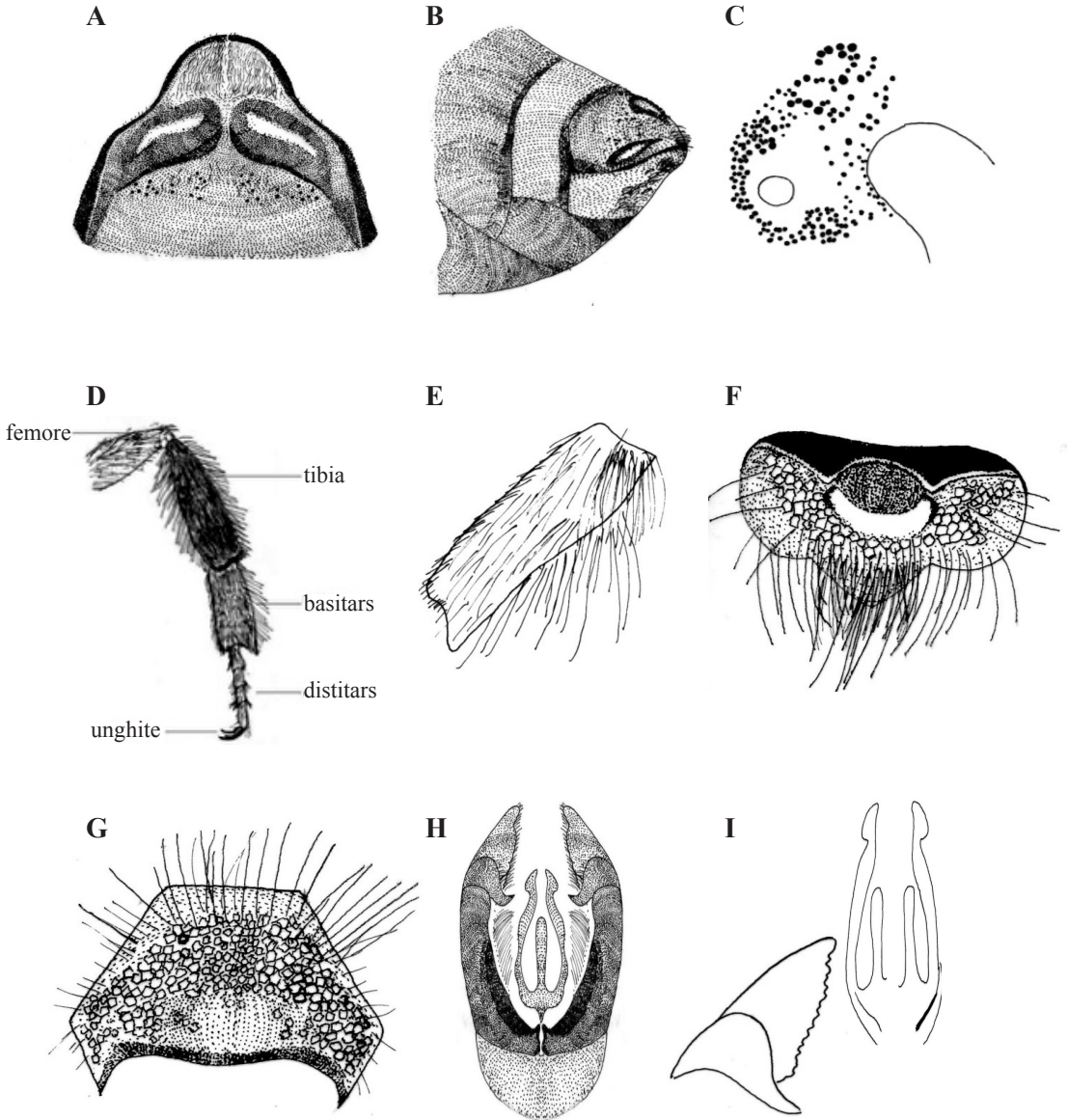
This study presents five species of Iranian species of subgenus *Psithyrus* which have been collected and examined:

**Table 1.** Iranian species of subgenus *Psithyrus* collected and examined.

No.	species	Examined Number	Collected Species		Reservation Place
			Male	Female	
1	<i>bohemicus</i> SEIDL	6	*	*	IPIM
2	<i>campestris</i> (PANZER)	0	-	-	NHM
3	<i>maxillosus</i> KLUG	9	-	*	IPIM
4	<i>quadricolor</i> (LEPELETIER)	1	*	-	IPIM
5	<i>sylvestris</i> (LEPELETIER)	0	-	*	NHM
6	<i>vestalis</i> (GEOFFROY )	45	*	*	IPIM
7	<i>rupestris</i> (FABRICIUS) (New Record)	3	-	*	IPIM



<b>ab</b> basal area or outer interspace	<b>pa</b> abductor swelling
<b>ac</b> acetabulum	<b>pd</b> first tooth
<b>as</b> upper distal angle	<b>ri</b> lower branch of condylar ridge
<b>ca</b> acetabular keel	<b>rs</b> upper branch of condylar
<b>cb</b> basal keel	<b>sa</b> acetabular groove
<b>cc</b> outer condylar ridge	<b>sb</b> basal furrow
<b>cd</b> adductor ridge	<b>sc</b> condylar groove
<b>ce</b> outer ridge	<b>sd</b> second tooth
<b>co</b> condyle	<b>se</b> outer groove
<b>cp</b> carena principale o ramo superiore della	<b>sm</b> median groove
<b>cs</b> second keel or lower distal branch of outer ridge	<b>so</b> sulcus obliquus or lower outer groove
<b>il</b> incisura lateralis	<b>ss</b> accompanying furrow or upper outer groove
<b>ma</b> distal margin	<b>td</b> third tooth



**Fig. 2:** ventral view callosities of *Psithyrus maxillosus* (A); latero-ventral of *Psithyrus vestalis* (B); ocello-ocular field punctures of *Psithyrus vestalis* (C); hind leg of *Psithyrus* (D); mid legs of *Psithyrus vestalis* (E); labrum of *Psithyrus vestalis* (F); clypeus of *Psithyrus vestalis* (G); genitalia (H); gonostylus, volsella and penis valve genitalia of *Psithyrus bohemicus* (I).

## Collecting localities and species diagnosis

### *Bombus (Psithyrus) vestalis* (GEOFFROY, 1758)

Syn.: *Psithyrus (Ashtonipsithyrus) vestalis* m. *bluethgeniellus* POPOV; PITTIONI (1937: 121)

*Psithyrus (Ashtonipsithyrus) vestalis* (GEOFFROY, 1758): BAKER (1996: 129)

**Material examined:** Ardabil: Meshkinshahr, 07.VIII.2014, 2 ♂♂; Meshkinshahr, Moeil, 29.V.2015, 1 ♀; Moeil, 15.VI.2015, 2 ♀♀; Mazandran: Ielaka, 09.V.2006, 1 ♂; Qazvin: Vikan, 30.VII.2006, 1 ♂; Vikan, 30.VIII.2006, 2 ♂♂; Verk, 27.V.2007, 3 ♀♀; Qazvin, 25.VII.2007, 2 ♀♀; Verk and Vikan, 08.VI.2011, 5 ♀♀ and 3 ♂♂; Verk and Vikan, Molem Kelayeh, 10.V.2012, 4 ♀♀; Bala Rouch, 19.VIII.2012, 2 ♂♂; Verk, 25.IX.2012, 6 ♂♂; Almot, Vikan, 26.VIII.2013, 5 ♀♀; Qazvin, 21.IV.2014, 3 ♀♀; Qazvin, 31.V.2014, 3 ♀♀; Qazvin, 04.V.2015, 2 ♀♀; Tehran: Tizkooh, 29.V.2006, 1 ♀; Tangetitalum (Tange lalun), 27.V.2006, 1 ♀; Dizin, Alborz, 12.VI.2006, 1 ♀; Karaj, 23.VII.2006, 1 ♂; Lalun, 2400 m, 24.VIII.2007, 1 ♂; Damavand, 14.VI.2015, 1 ♀.

**Female:** Length 28.9 mm, wingspan 37 mm. Head black; long black hairs around the base of antenna and upper part close to clypeus. Vertex with black hairs. Punctures in ocello-ocular area, few and small, no dept (Fig. 7, A). First antennal segment short and the same size as rest segments. Long black hairs around antennal. scape with black short hairs. Clypeus with small dense punctures. Clypeus and Labrum (Fig. 16, G). Clypeus covered with long hairs especially in upper and lateral parts (Fig. 9, A) (Fig. 16, H). Labrum with middle furrow deep and long hairs, a tuft long black hairs below the furrow. Labrum with two well-developed tubercles. Around lateral ocellous deeper than in *B. maxillosus* especially in distal part (Fig. 8, A, B) (Fig. 16, I). Below eyes with pale short yellow hairs. Malar area smooth with less fine punctures than *B. maxillosus*. Mandible similar to (Fig. 7, D). Main keel of the mandible more or less distinct, shaped like a short stump or a little branched. Thorax: collar yellow, allar space black, scutellum black. Terga 1 and 2 black, terga 3 to 5 with variation in color similar to fig. 3 (A, B, C, D and E). Wings always smoggy. Outer surface of mid basitarsus with long hairs more or less numerous. Hair fringe on rear edge of mid basitarsus with hairs variable in length according to the species (Fig. 10, D). Abdomen, terminated sharply, Callosities on sixth sternite convergent to apex, form a V-shape (Fig. 6, C, F) (Fig. 13, D, E and F).

**Male:** Length 19.5 mm, wingspan 30.3 mm. Head: Vertex with intermixed long yellow and black hairs. Clypeus with long black hairs and medium-large punctures at lower middle of clypeus, near of median-posterior part with a few fine punctures or without punctures and with short hairs. Labrum maxilles with two projecting on, with long black hairs. Lower part of labrum with medium-large punctures, median longitudinal furrow of labrum low deep and flat, labrum with short yellow hairs, malar area with less punctures and with very short yellow hairs. antenna first and second segment of flagellum shorter than remained segments and first segment is longer than second segment. gena with medium black hairs. Thorax: collar yellow, allar band and scutellum black, tergum 1 always yellow at least in sides, terga 2 and 3 black, tergum 4 yellow but terga 5 and 6 variable; tergum 7 usually black similar to Fig. 3 (F, G and H). Leg: coxa of all three legs with long black hairs, fore leg and mid leg black and distarsus brown, tibia and basitarsus with long fringe (Fig. 10, C). Hind tibia black with two brown spins, one spin longer than rest two spins. Inner surface of hind basitarsus brown and outer black. Anterolateral part of basitarsus with long fringe of hairs. Mid of hind basitarsus area concave. Genitalia: Gonocoxae and

spata brown moderately sclerotized, gonostylous and volsella yellowish. Inner dents of gonostylus strongly sclerotized with dense branched hairs. Volsella triangular at apex, in the inner proximal with short yellowish hairs. Penis valve distally curved inward and stylar shape at end (Fig. 11, A, B and C) (Fig. 14, H, I)..

***Bombus (Psithyrus) maxillosus* (KIRBY, 1802)**

**Material examined:** Mazandran: Damavand, Polour, 28.V.2015, 1 ♀; Qazvin: Verk and Vikan, 08.VI.2011, 1 ♀; Verk and Vikan, Molem Kelayeh, 10.V.2012, 6 ♀♀; Ardabil: Moeil, 15.VI.2015, 1 ♀.

**Female:** Length 27 mm, Wingspan 39.6 mm. Head black, with brownish yellow hairs on top. Head: vertex with black, white and yellow hairs. the vertex, frons (compound eyes and ocellus), gena, paracocular area, with the medium, low deep, density punctures and frontal line without punctures (Fig. 7, B). Antennae, area around of antennal socket with long black hairs and scape with median yellow hairs, pedicel and flagellum without hair. Clypeus and labrum (Fig. 15, A) Clypeus, Middle of supraclypeal area convex, epistomal suture of the Clypeus with long hairs, posterior clypeus less and shorter than anterior hairs, middle of clypeus smooth, posterior clypeus with one band short yellow hairs (Fig. 9, B) (Fig. 15, B), labrum, side of labrum angle of 45° the projecting and two hump-like with long black hairs, the middle of anterior labrum low similar triangular, and with long yellow hairs (Fig. 8, C, D) (Fig. 15, C). Malar area with short hairs and very fine, low density punctures. The width of the malar area is 4 times or more the length of the antennal segment IV. Mandible, Basal area or outer interspace of mandible with short, sparse, low density yellow hairs, outer condylar ridge anterior-posterior with long black hairs that is posterior shorter hairs. area (acetabular groove, median groove, outer groove, condylar groove) with median and densely yellow hairs, outer groove with median black hairs in the ridge end line. The smooth and polished tooth; First tooth and a second tooth placed in a line and distal margin slightly sunken, third tooth and incisura lateralis smooth lines (Fig. 7, F). Thorax collar and scutellum variable almost intermixed black and yellow, the between the wing bases black, T1, T2 and T6 black, side of T4 yellow, T3, T5 variable usually black similar to (Fig. 4, A) Thorax black with a brownish yellow band on the collar, and a narrower, somewhat lighter band on the scutellum Thorax: black and the collar, the area between the wing bases and scutellum with fine but not deep and dense punctures, anterior collar with yellow hairs and posterior scutellum with yellow hairs and remainder (remains) hairs of collar, between the wing base and scutellum with greyish black, wings dark brown. Posterior distal angle of mid basitarsus clearly spinose (Fig. 4, A, B and C). Hair fringe on rear hedge of hind tibia shorter than the width of the segment. Leg: surface trochanter, femor cover with median grey and black hairs. Mid leg, femor with long black hairs, tibia and basitarsus with median black hairs, mid tibia the posterior corner with one spin straight and proximal end curved. distitarso with brown hairs (Fig. 10, E). Hind tibia with black hairs, tibia with two spin hook-like, outer surface basitarsus with short black hairs and inner surface with brown hairs and distitarso with yellow and black hairs. outer surface basitarsus with concave, tibia cover with black hair (Fig. 10, A). Abdominal T1 mostly black, but often with yellow hairs intermixed, T2 and T3 black, but T3 may be yellow apically; T4 and T5 white (Fig. 4, A, B and C). Callosities: Dorsal view with con-

cave in middle of callosities and with brown hairs gradually in side of yellow hairs. Lateral view in side of concave proximal outer smooth and straight and side of grey hairs, lowest rather with yellow hairs. Ventral view plate-like and with fine, scattered hairs. Callosities on St6 prominent, forming a semi-circle form a U-shape (Fig. 13, A, B and C) (Fig. 6, B, E).

***Bombus (Psithyrus) rupestris* (FABRICIUS, 1793) (New record)**

**M a t e r i a l e x a m i n e d :** Qazvin: Verk and Vikan, 31.V.2014, 3 ♀♀.

**F e m a l e :** Length 24 mm, wingspan 28 mm. Head: Head and thorax black, vertex and around the antenna with white and grey, Puncture in ocello-ocular area (Fig. 7, C). Clypeus and Labrum (Fig. 15, D). Clypeus with small-large punctures, side of and posterior clypeus with more small punctures. In the middle low convex (projecting), side of clypeus without one band hairs and with long hairs, posterior area with short hairs (Fig. 9, C) (Fig. 15, D). Labrum, The width of the central furrow of the labrum, measured between the distal end of the tubercles, shorter than or equal to 1/3 of the length of the labrum; furrow proximally widening (Fig. 8, E, F) (Fig. 15, F). Malar area The length of the malar area is 0.6-0.8 times its distal width. mandible with two grooves to not proximal the end. Main keel of the mandibles confluent with the distal margin or not, in any case longer than 3/4 of the distance between the point of the bifurcation with the second keel and the distal margin (Fig. 7, E). Thorax: anterior collar and posterior scutellum with pale yellow hairs and remaining area with black hairs (Fig. 5, A). Wings brown and black. Leg, tibia hind leg with median hairs with two spines (Fig. 10, B). Abdomen, terga 1-5 with black hairs and tergum 6 with red hairs. Abdominal T1-3 black; T4 and T5 orange-red, T6 dull and clothed with very short, inconspicuous, red hairs (Fig. 5, A). Callosities: Sharp tip and V-shape. Callosities on sixth sternite thin and sharp. Surface of sixth sternite, among the puncturing, shagreened and dull (Fig. 6, A, D) (Fig. 13, G, H, I).

***Bombus (Psithyrus) bohemicus* (SEIDL, 1837)**

**Syn.:** *Psithyrus (Ashtonipsithyrus) bohemicus* (SEIDL); BAKER (1996: 128)

**M a t e r i a l e x a m i n e d :** Meshkinshahr, Shabil and Ghutursoei, 28.VII.2011, 2 ♂♂, 1 ♀; Meshkinshahr, Moeil, 08.VIII.2014, 1 ♂, 29.V.2015, 1 ♀, 15.VI.2015, 1 ♀.

**M a l e :** Length 17.5 mm., Wingspan 22 mm. Head: Head black, Sometimes with pale yellow hairs on top. vertex with medium long black hairs in between them medium long yellow hairs. Ocello-ocular with long hairs, around antenna area with long black hairs, antenna black and two segment flagellum shorter than remaining flagellum segments. Antenna short, flagellum c. 5 mm. clypeus with long black hairs and medium-large punctures, side of clypeus between middle of clypeus convex (projecting). Posterior –middle of clypeus with short dark brown hairs, gena with medium-short black hairs. Side of labrum projecting and with large punctures. Median longitudinal furrow of labrum with long black hairs, posterior with short-long black hairs, side of more long hairs and in middle of labrum more short hairs. posterior labrum short-median yellow hairs. mandible two teeth nearly posterior a row long black hairs. Thorax, Collar with pale yellow hairs, the between



the wing bases with black hairs, scutellum with yellow hairs. Wings bright and shining. Hind tibia with short black hairs, basitarsus broad and with medium-long black and brown hairs and distitarsus without hairs. Abdomen, Abdominal T1 usually yellow; T2 black; T3 black in the middle and towards the base, but pale yellow at the sides; T4, T5 and sides of T6, white; remainder of T6 and T7, more or less black. Tail white or yellow. As in females the yellow soon fades. A variety occurring in Scotland has the white of the tail replaced by yellow. Coat rather dense, long and uneven (Fig. 15, B, C). Hair of the thoracic dorsum with yellow anterior and posterior bands with black between the wing bases, T1 yellow or black, T4–7 white or black. Genitalia: gonostylus with short-medium very dense hairs with projecting and apex pointed, volsella inner margin very toothed, posterior broad and supra area narrower, volsella with short-medial hairs and middle of area with projecting edge, Penis valvae with middle tooth not clearly developed. Genitalia (Fig. 14, A, B) (Fig. 11, D, E and F). Volsellae with sharp apex. Genitalia similar to those of *vestalis*, but inner edges of the volsella and squama less hairy. St 7 (Fig. 14, C, D), St 8 (Fig. 12, G, H).

***Bombus (Psithyrus) quadricolor* (LEPELETIER, 1832) (POPOV)**

Syn.: *Psithyrus (Fernaldaepsithyrus) quadricolor* ssp. *rossicus* Pop. PITTONI (1937: 122)

*Psithyrus (Fernaldaepsithyrus) quadricolor* LEPELETIER, 1833; BAKER (1996: 129)

Material examined: Mazandran: Rudbarak, 19.VIII.2011, 1 ♂.

Male: Length 21 mm, wingspan 25 mm. Head: supra ocellus area triangular, supra area with long yellow hairs and gena with short-long hairs. Front (supra antenna area) with dense black and yellow hairs, Flagellum of antenna first and second segment shorter than remaining segments and first segment as long as second segments. Labrum two projecting flat surface and with very low and nearly evenly smooth punctures. Mandible two teeth on to posterior with one band short-long yellow hairs. Thorax: collar with yellow hairs, between the wing base and scutellum with yellow hairs, wing bright and shining. Hind tibia with long black hairs, basitarsus short-medium yellow hairs and with long black hairs, posterior basitarsus of hind leg with long yellow hairs and side of with long yellow hairs. Mid basitarsus, meta basitarsus and hind tibia with hair fringe longer than the greatest width of the segment. Abdomen: tergum 1 with yellow hairs, tergum 2 with black hairs, terga 3–6 with white hairs, tergum 7 with orange hairs (Fig. 5, D). Genitalia: Volsella and Gonostylus, Volsella and anterior volsella with short yellow hairs. Gonostylus with short-long yellow hairs. Anterior gonocoxa thumb-like broadly (Fig. 12, I, J, K) (Fig. 14, E, F and C).

Colour pattern

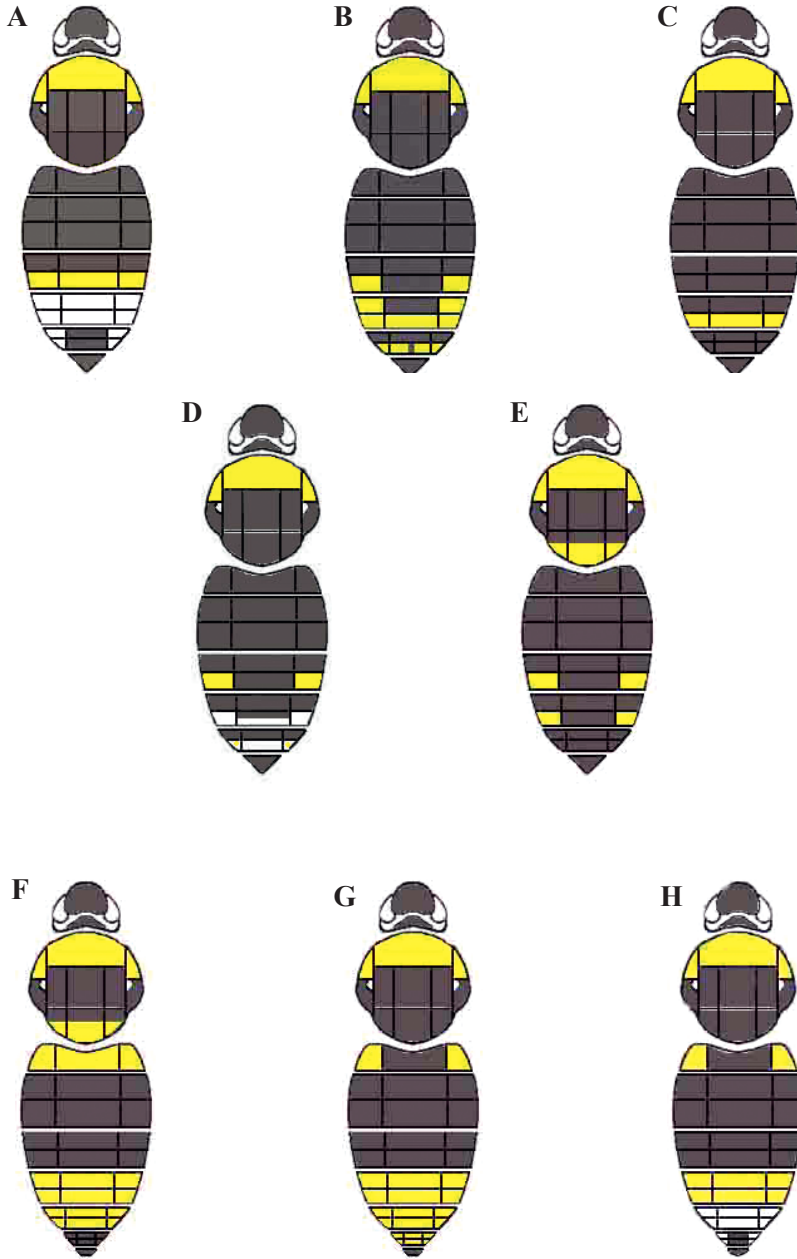
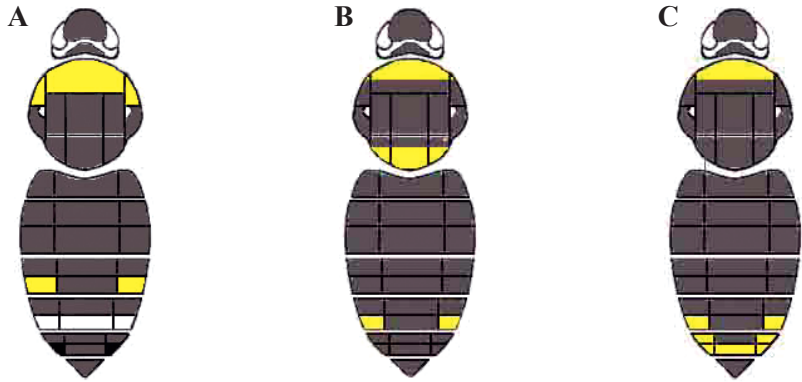
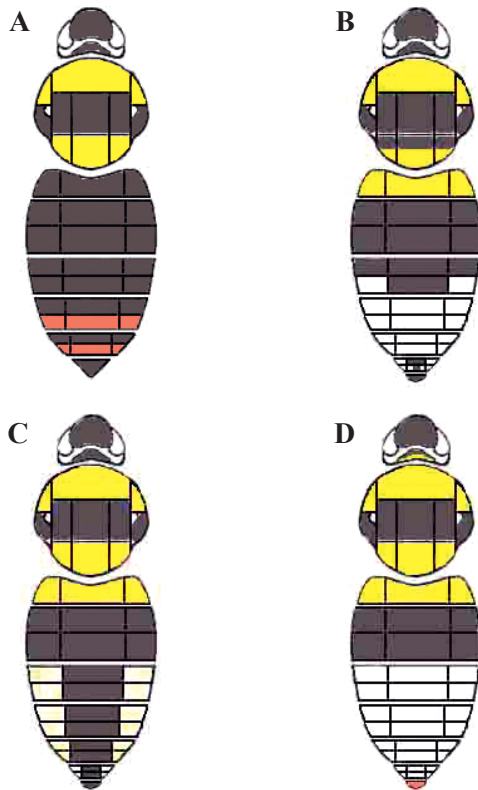


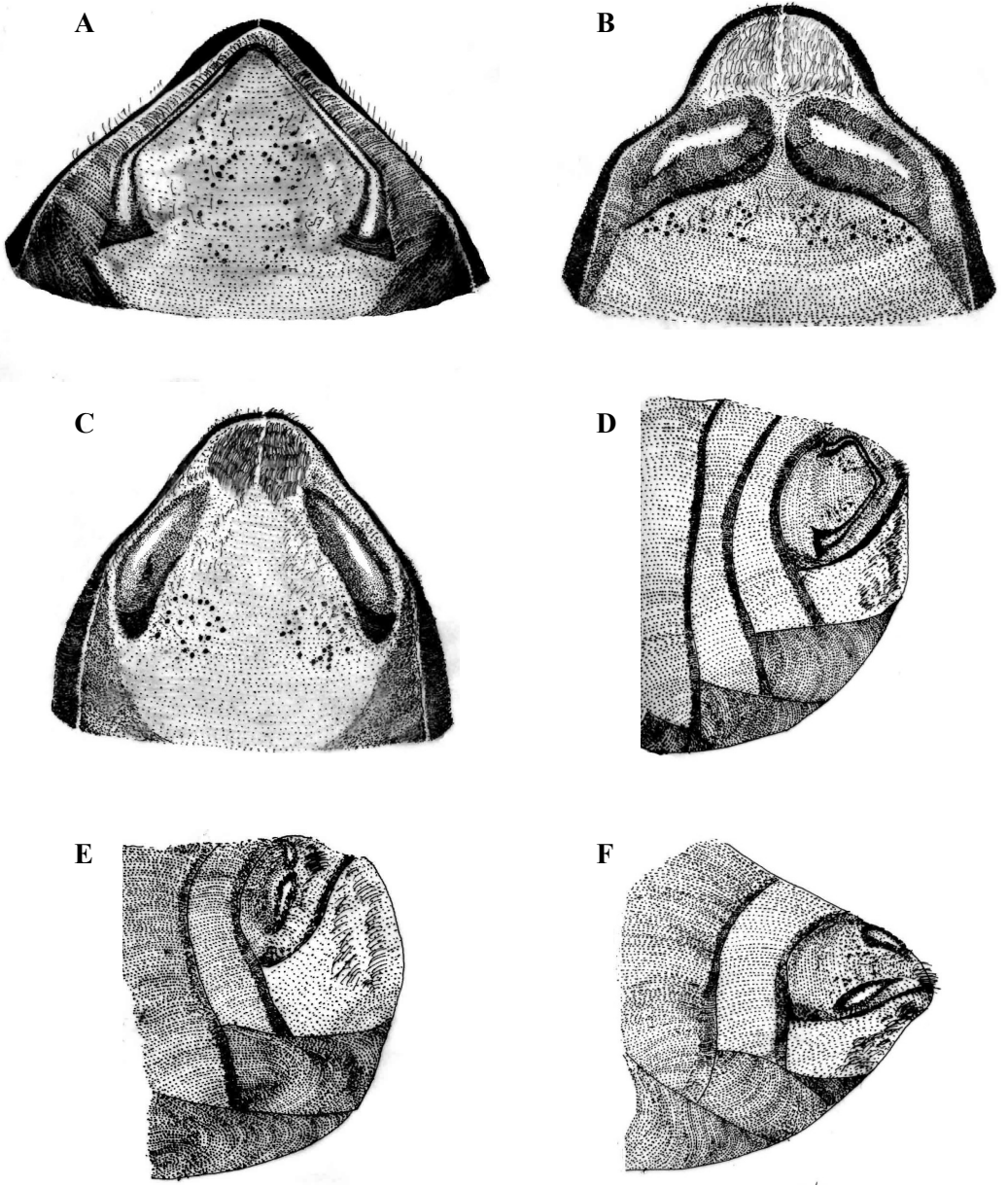
Fig. 3: Color pattern in female *B. (Psithyrus) vestalis* (A, B, C, D, E) and male (F, G, H).



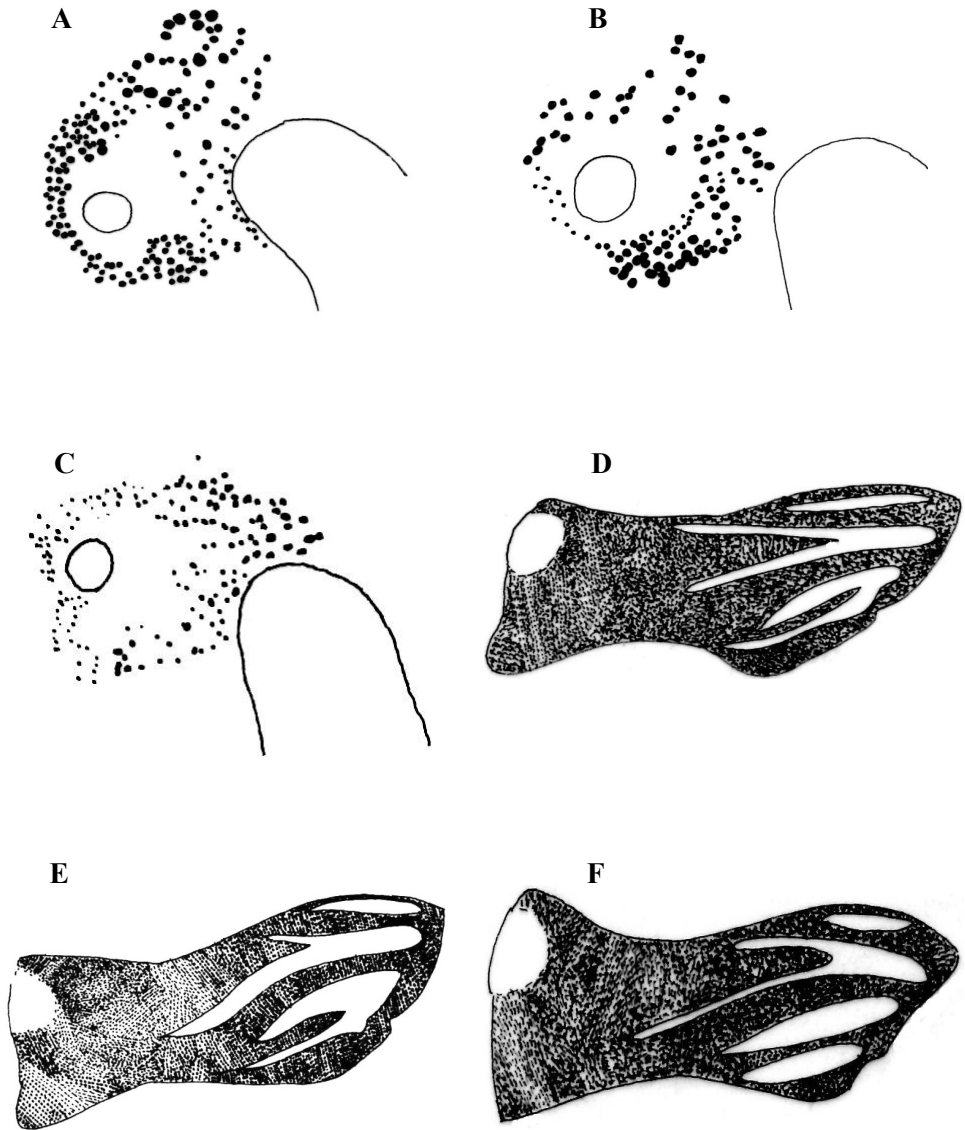
**Fig. 4:** Color pattern in female *Psithyrus maxillaceus*.



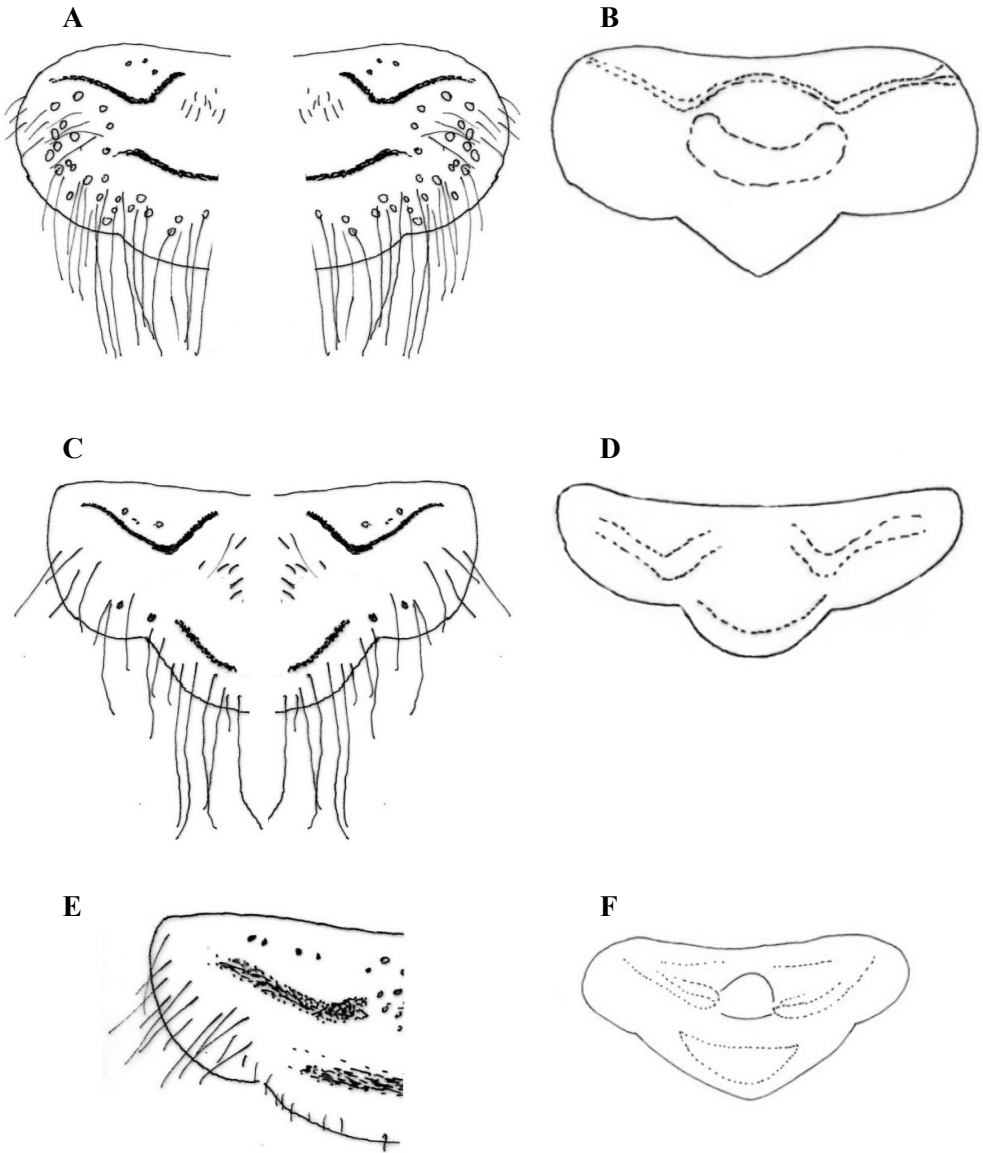
**Fig. 5:** Color pattern in female *Psithyrus rupestris* (A), *Psithyrus bohemicus* (B, C) and male *Psithyrus quadricolor* (D).



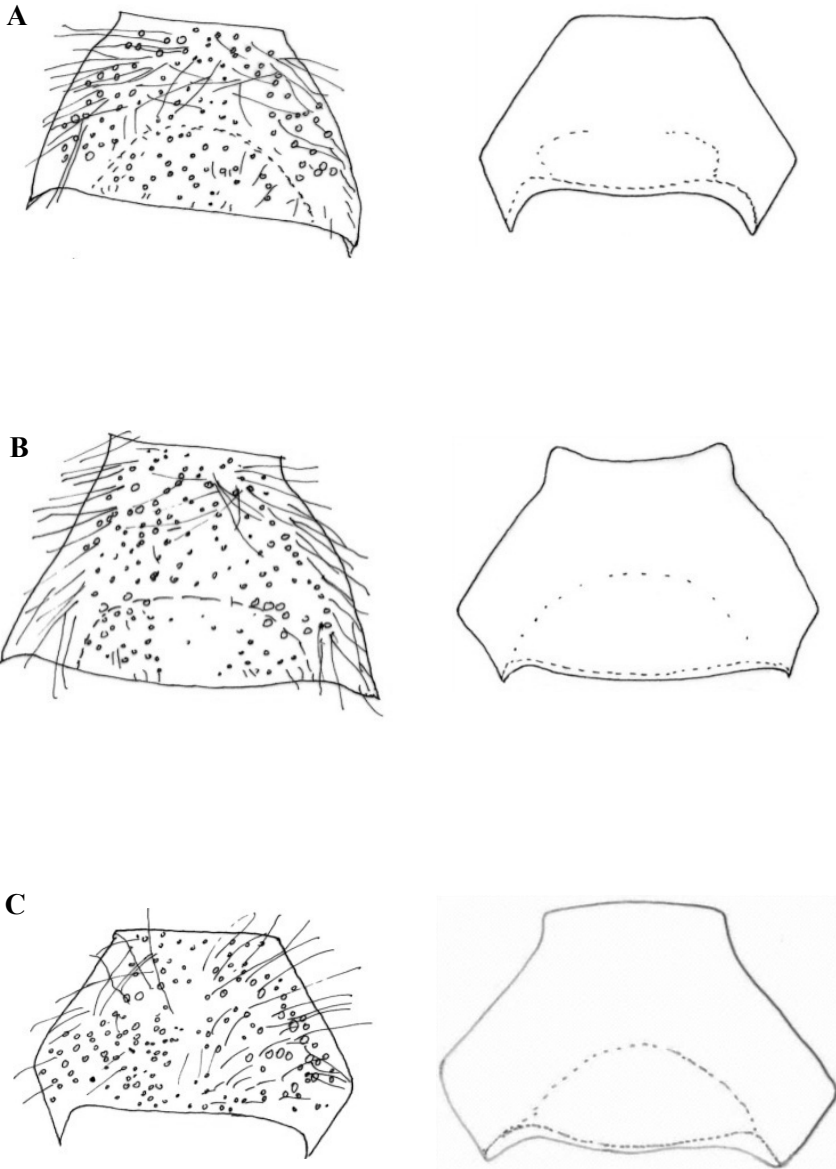
**Fig. 6:** Callosities in *Psithyrus rupestris* (A, D), *Psithyrus maxillosus* (B, E) and in *Psithyrus vestalis* (C, F).



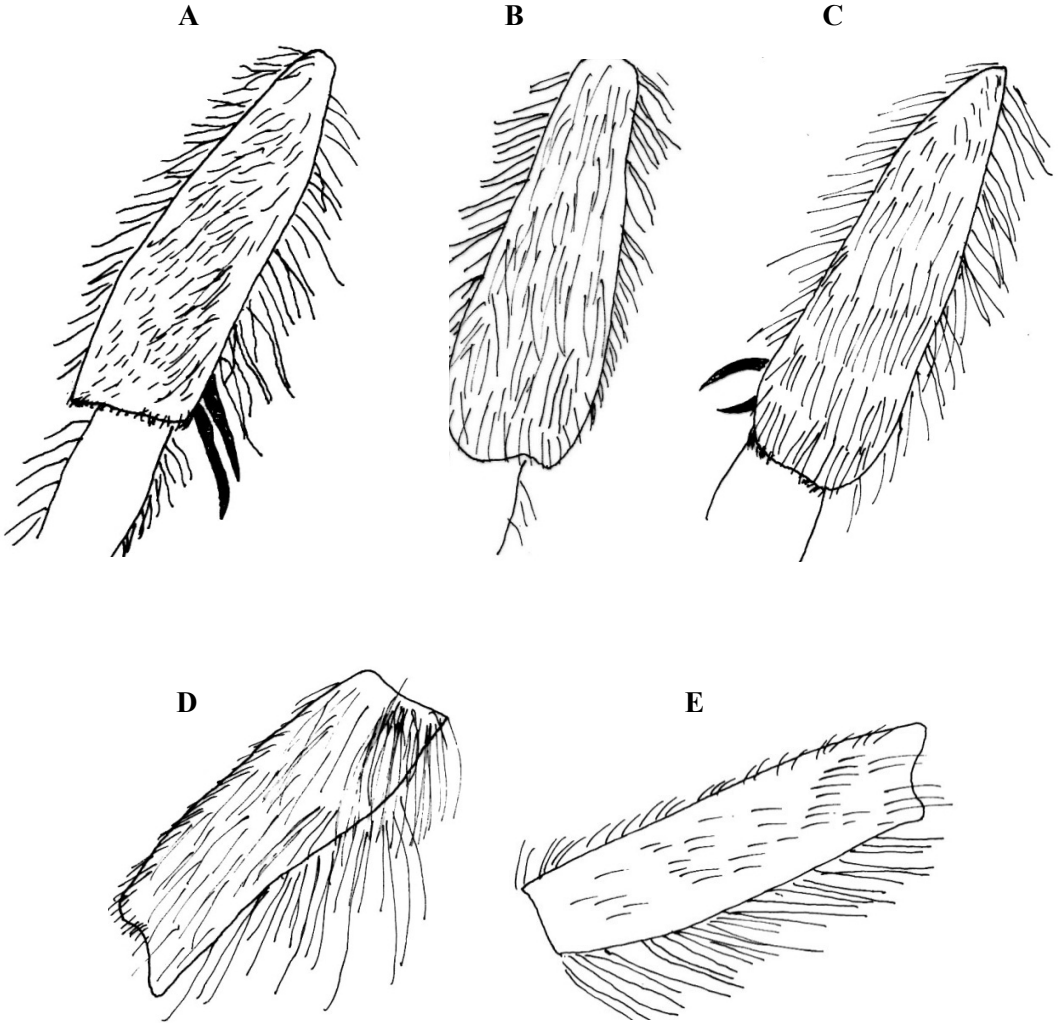
**Fig. 7:** Characters of punctures in *Psithyrus vestalis* (A), *Psithyrus maxillosus* (B), *Psithyrus rupestris* (C), *Psithyrus rupestris* (D), mandible in *Psithyrus vestalis* (E) and *Psithyrus maxillosu* (F).



**Fig. 8:** Labrum of *Psithyrus vestalis* (A, B), *Psithyrus maxillosus* (C, D) and *Psithyrus rupestris* (E, F).

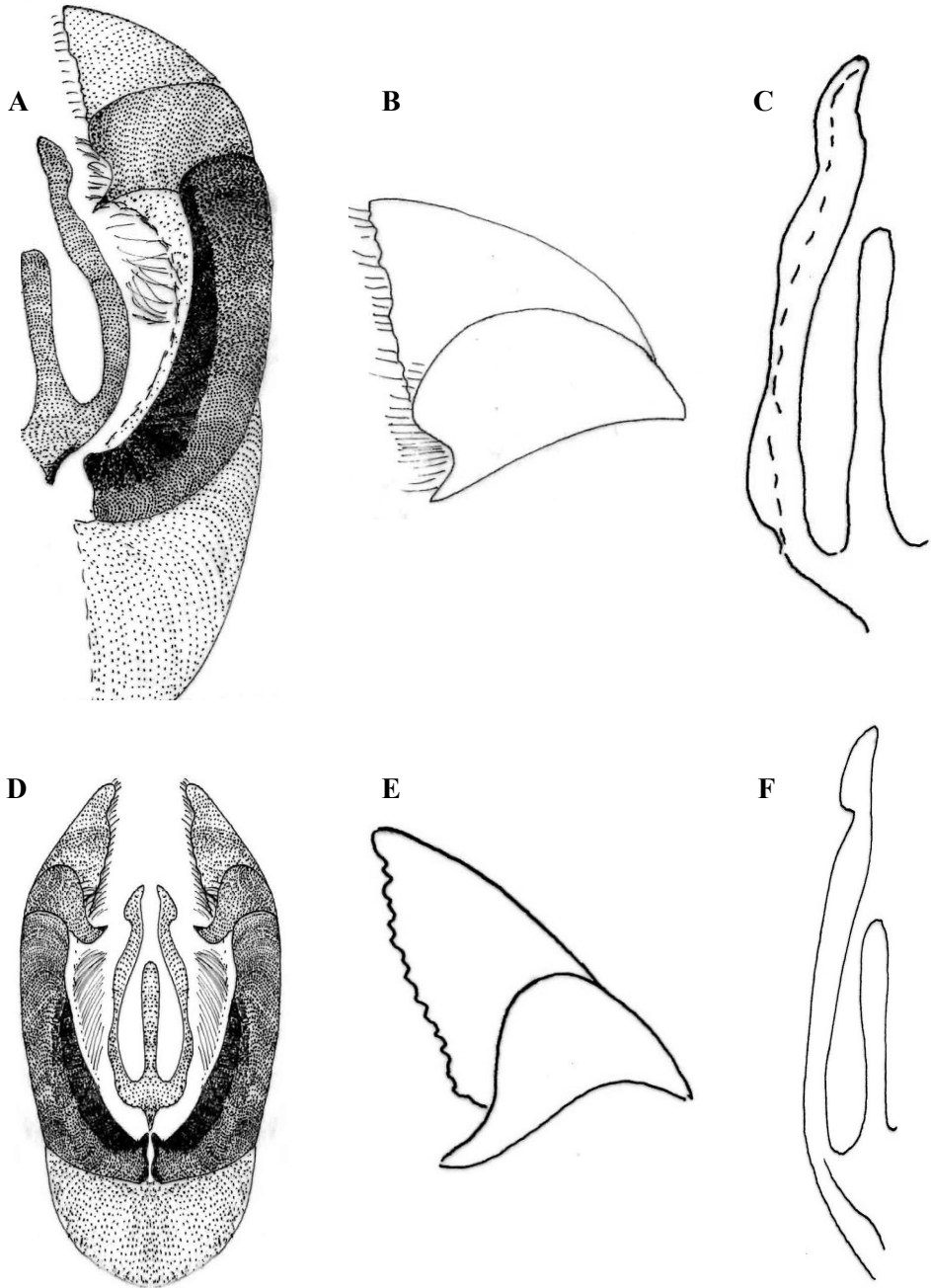


**Fig. 9:** Clypeus in *Psithyrus vestalis* (A), *Psithyrus maxillosus* (B) and *Psithyrus rupestris* (C).



**Fig. 10:** Hind leg-tibia of *Psithyrus maxillosus* (A), *Psithyrus rupestris* (B) and *Psithyrus vestalis* (C); Mid basitarsus in *Psithyrus vestalis* (D) and *Psithyrus maxillosus* (E).





**Fig. 11:** Genitalia of *Psithyrus vestalis* (A, B, C) and of *Psithyrus bohemicus* (D, E, F).

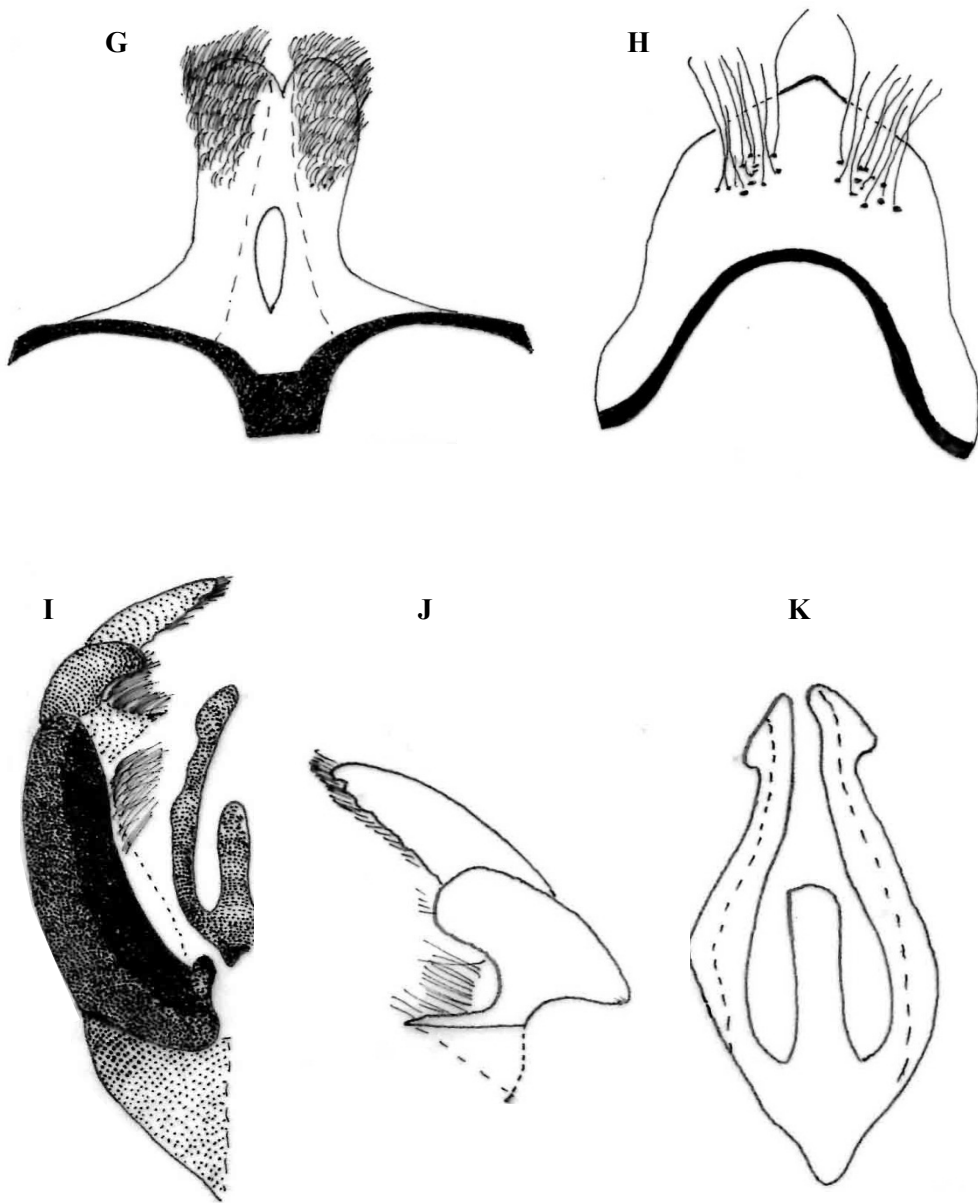
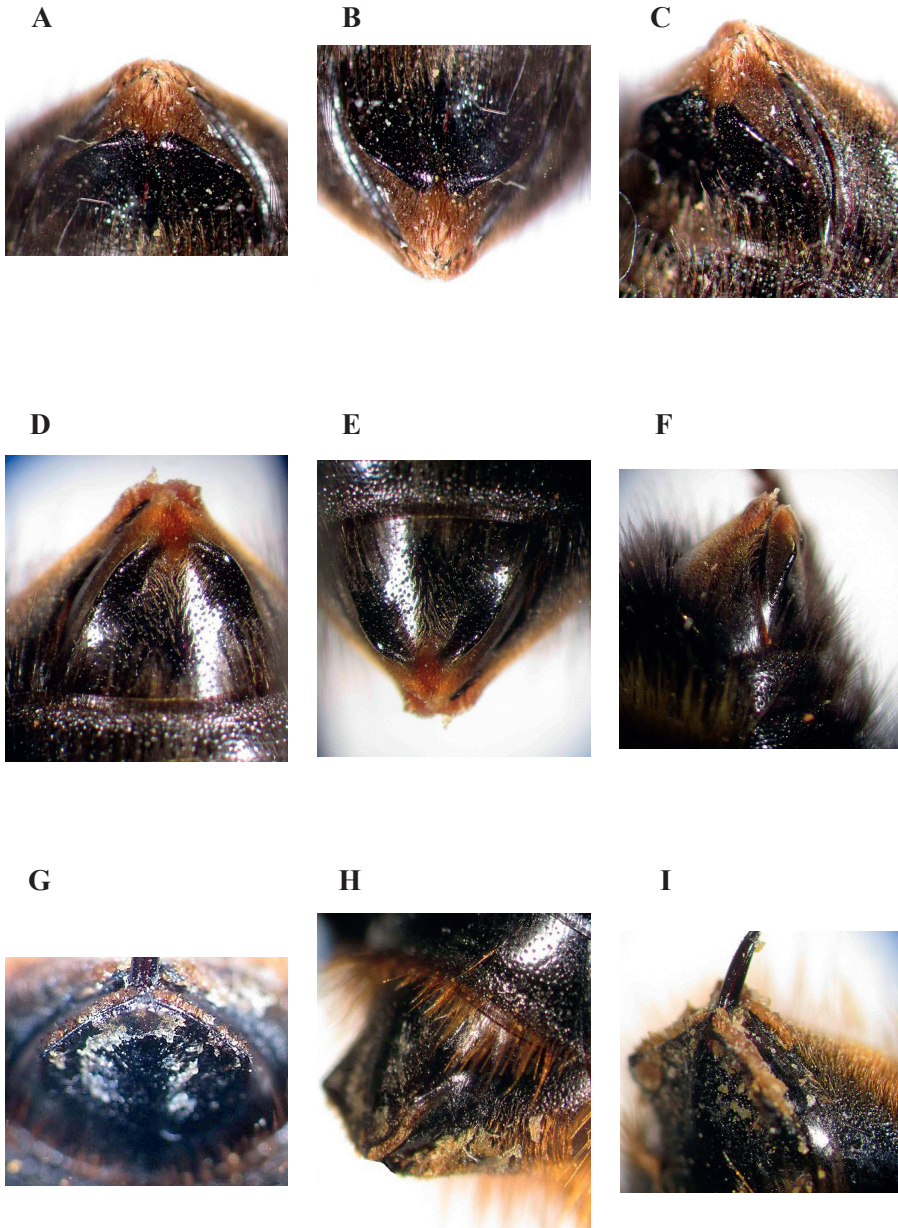
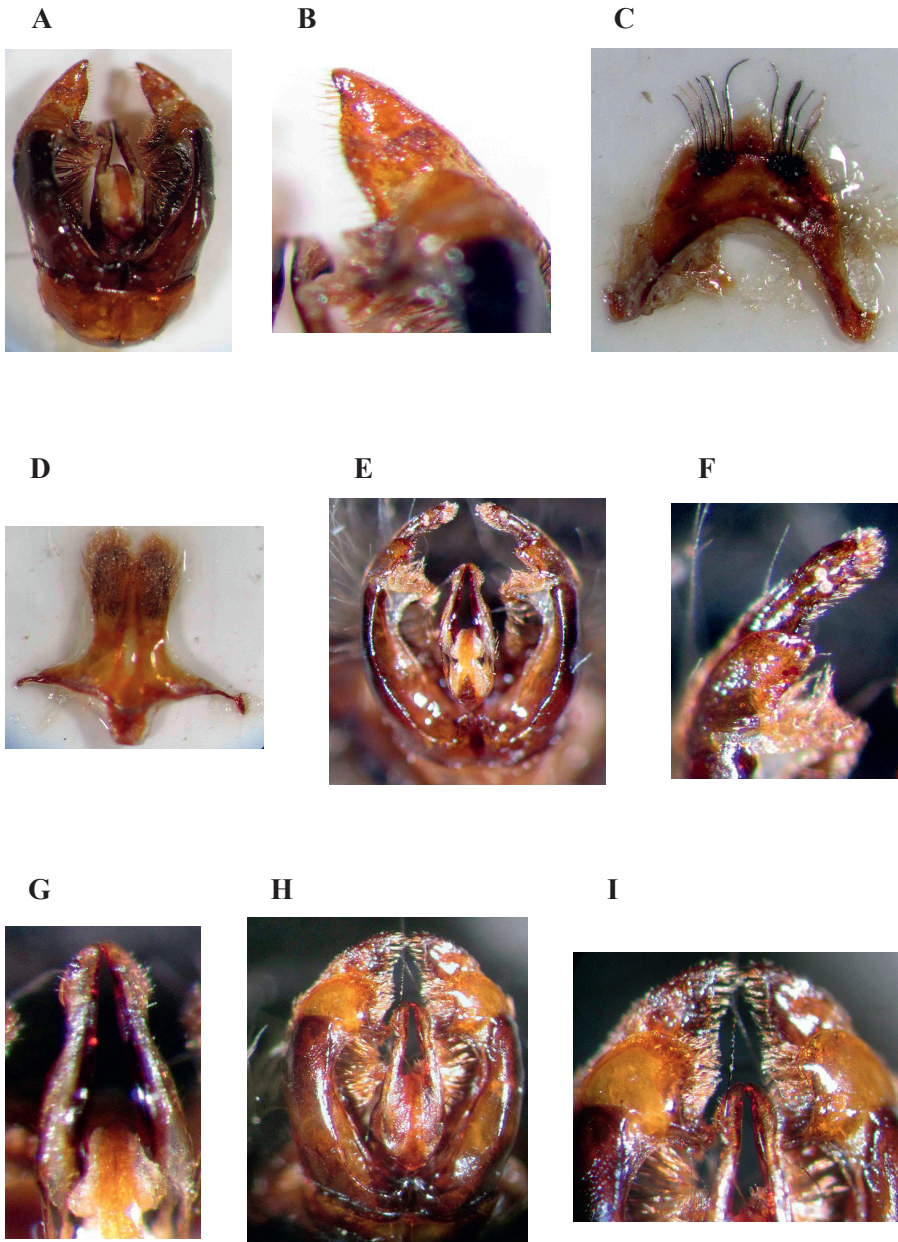


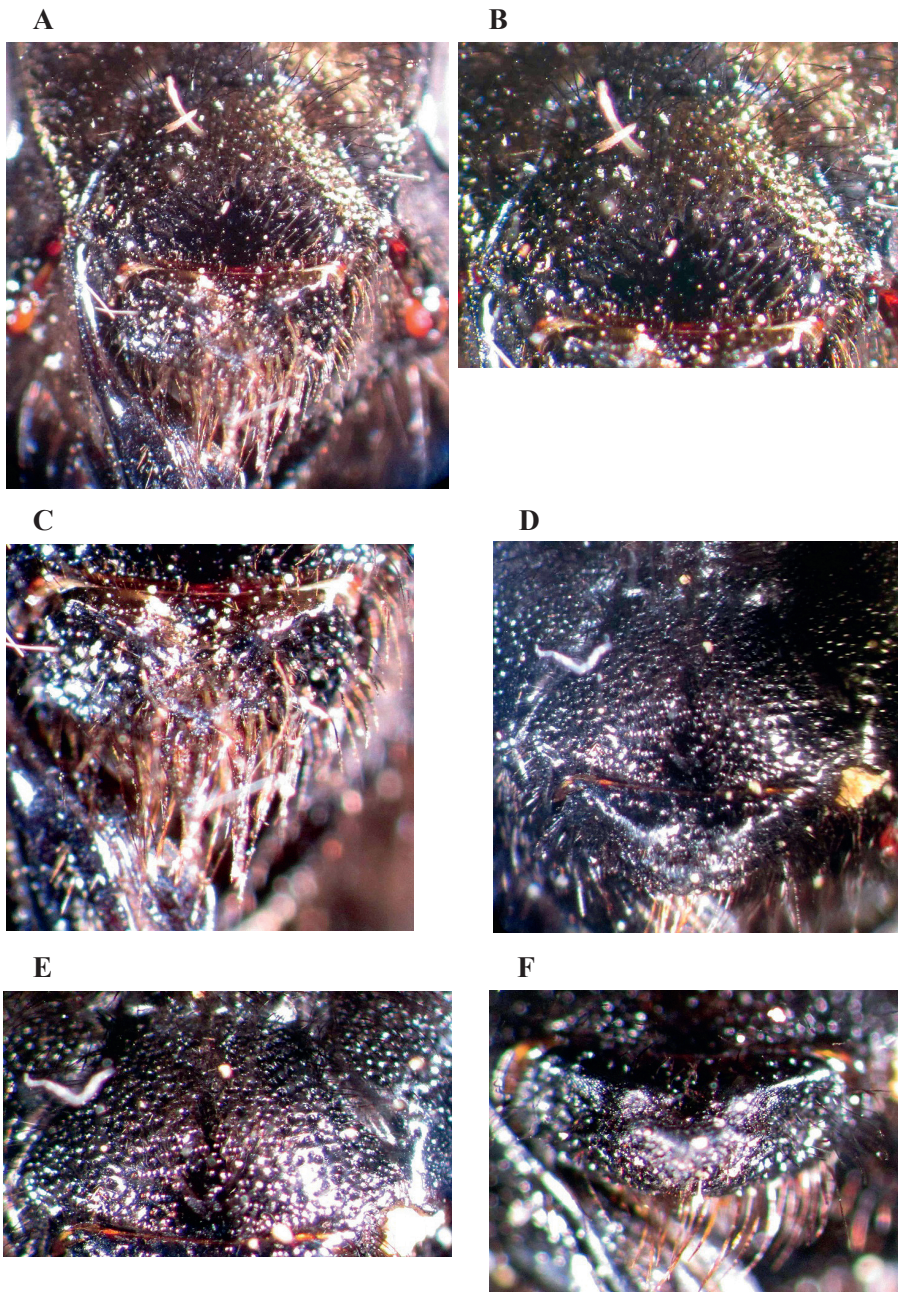
Fig. 12: Genitalia in *Psithyrus bohemicus* (G, H) and in *Psithyrus quadricolor* (I, J, K).



**Fig. 13:** Callosities in *Psithyrus maxillosus* (A, B, C), *Psithyrus vestalis* (D, E, F), *Psithyrus rupestris* (G, H, I).



**Fig. 14:** Genitalia *Psithyrus bohemicus* (A, B, C, D), *Psithyrus quadricolor* (E, F, G), *Psithyrus vestalis* (H, I).

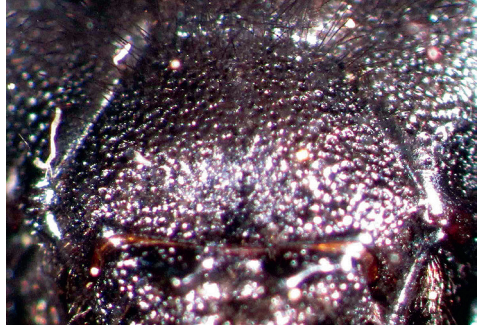


**Fig. 15:** Clypeus and labrum in *Psithyrus maxillosus* (A, B, C), *Psithyrus rupestris* (D, E, F).

G



H



I



**Fig. 16:** Clypeus and labrum *Psithyrus vestalis* (G, H, I).

## References

- ALFORD D.V. (1975): Bumblebees. Davis-Poynter, London, U.K., 352 pp.
- BULMER M.G. (1983): The significance of protandry in the social Hymenoptera. – *Journal of Theoretical Biology* **93**: 239–251.
- FISHER R.M. (1987): Queen-worker conflict and social parasitism in bumble bees (Hymenoptera: Apidae). – *Animal Behaviour* **35**: 1026–1036.
- FREHN E. & K. SCHWAMMBERGER (2001): Social parasitism of *Psithyrus vestalis* in free-foraging colonies of *Bombus terrestris* (Hymenoptera: Apidae). – *Entomologia Generalis* **25**: 103–105.
- GOULSON D. (2010): Bumblebees Behaviour, Ecology, and Conservation. (Second Edition). – Oxford University Press. 330 pp.
- ITO M. (1985): Supraspecific classification of bumblebees based on the characters of male genitalia. – *Contributions from the Institute of Low Temperature Science, Hokkaido University (B)*, **20**: 143 pp.
- OBRECHT, E. & A. SCHOLL (1981): Enzymelektrophoretische Untersuchungen zur Analyse der Verwandtschaftsgrade zwischen Hummel und Schmarotzerhummelarten (Apidae, Bombini). – *Apidologie* **12**: 257–268.
- PAMILO P., PEKKARINEN A. & S.-L. VARVIO (1987): Clustering of bumblebee subgenera based on interspecific genetic relationships (Hymenoptera: Apidae: Bombus and Psithyrus). – *Annales Zoologici Fennici* **24**: 19–27.
- PLOWRIGHT R.C. & W.P. STEPHEN (1973): A numerical taxonomic analysis of the evolutionary relationships of Bombus and Psithyrus (Apidae: Hymenoptera). – *The Canadian Entomologist* **105**: 733–743.
- SAKAGAMI S.F. (1976): Species differences in the bionomic characters of bumblebees. A comparative review. – *Journal of the Faculty of Science, Hokkaido University, ser. 6, Zoology* **20**: 390–447.
- WILLIAMS P.H. (1991): The Bumblebees of the Kashmir Himalaya (Hymenoptera: Apidae, Bombini). – *Bulletin of the British Museum (Natural History) (Entomology)*, **60**: 1–204.
- WILLIAMS P.H. (1995): Phylogenetic relationships among Bumblebees (*Bombus Latralis*): a reappraisal of morphological evidence. – *Systematic Entomology*, **19**: 327–344.
- WILLIAMS P.H. (1998): An annotated checklist of bumblebees with an analysis of patterns of description (Hymenoptera: Apidae, Bombini). – *Bulletin of The Natural History Museum (Entomology)*, **67**: 79–152.
- WILLIAMS P.H. (2008): Do the parasitic *Psithyrus* resemble their host bumblebees in colour pattern? – *Apidologie*, **39**: 637–649.
- WILLIAMS P.H. (1985): A preliminary cladistic investigation of relationships among the bumble bees (Hymenoptera, Apidae). – *Systematic Entomology* **10**: 239–255.

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