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New data on distribution of four species of the genus *Trypoxylon* (Hymenoptera: Crabronidae: Trypoxylini) in European Russia

Новые данные о распространении четырех видов рода *Trypoxylon* (Hymenoptera: Crabronidae: Trypoxylini) в европейской части России

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KEY WORDS: Hymenoptera, Crabronidae, Trypoxylini, *Trypoxylon*.

КЛЮЧЕВЫЕ СЛОВА: Hymenoptera, Crabronidae, Trypoxylini, *Trypoxylon*.

ABSTRACT. New data on distribution of four species of digger wasps of the genus *Trypoxylon* (Crabronidae: Trypoxylini) in European Russia are provided. *Trypoxylon beaumonti* Antropov, 1991 is recordered for the first time for Russia, *T. koreanum* Tsuneki, 1956 is recordered for the first time for European Russia, an areal of *T. rubiginosum* Gussakovskij, 1936 is specified, and previously unknown female of *T. inopinatum* Antropov, 1986 is described.

РЕЗЮМЕ. Приведены новые данные о распространении в Европейской части России четырех видов роющих ос рода *Trypoxylon* (Crabronidae: Trypoxylini). *Trypoxylon beaumonti* Antropov, 1991 впервые указан с территории России, *T. koreanum* Tsuneki, 1956 впервые указан из Европейской части России, уточнен ареал *T. rubiginosum* Gussakovskij, 1936 и впервые описана неизвестная ранее самка *T. inopinatum* Antropov, 1986.

Trypoxylon beaumonti Antropov, 1991

Trypoxylon beaumonti Antropov, 1991, ♀, ♂

MATERIAL. RUSSIA: 4♀♀, 6♂♂, Krasnodar reg., Gelendzhik distr., Krinitsa env. 44,400°N 38,316°E, forest stream. 6–13.IX.2009 (K. Tomkovich) [Zoological Museum of Moscow Lomonosov State University — ZMMU].

DISTRIBUTION. *Trypoxylon beaumonti* was described in the revision of the species-subgroup *attenuatum* on a series of specimens of the both sexes from Portugal, France, Italy, Switzerland, Germany, and Austria.

In the next years distribution of *T. beaumonti* was confirmed for France [Ljubomirov, 1999; Schmid-Egger, 2001; Vago, 2007; Frommer, 2009b; van der Smissen, 2010; Schmid-Egger, 2011; Bitsch, 2014], Italy [Mochi, Luchetti, 1994; Pagliano, 1994; Negrisolo, 1995; Pagliano, Scaramozzino, 1999; Pagliano, Negrisolo, 2005; Pagliano, 2009; Strumia et al., 2012], Switserland [Neumeyer, 2000], Germany [Schmid-Egger, 1994, 1995; Schmid-Egger et al., 1995; Schmidt et al., 1995; Schmid-Egger et al., 1996; Schmid, Schmid-Egger, 1997; Mader, Chalwatzis, 2000; Schmid-Egger, 2000; Ohl et al., 2001; Mandery et al., 2003; Jacobs, 2007; Frommer, 2009a, b; Schmid-Egger, 2010; Tischendorf et al., 2011; Frommer, 2014], and Austria [Gusenleitner, 1995; Zettel et al., 2013; Zettel et al., 2014], and also was expanded to Spain [Tormos et al., 1996; Tormos et al., 2005], Andorra [González et al., 2000], Slovakia [Deván, 2004; Vepřek, Straka, 2007], Czech Republic [Vepřek, Straka, 2007; Dvořák et al., 2008], Hungary [Frommer, 2009b], Slovenia [Gogala, 2011], Greece [Standfuss, Standfuss, 2006, 2012], and Bulgaria [Ljubomirov, 1999; Guéorguiev, Ljubomirov, 2009].

Trypoxylon beaumonti is recorded from Russia for the first time.

DISCUSSION. Occipital carina forming in its lower corners a pair of widened lobes separated from the posterior side of the head and long erect pubescence, particularly on the lower part of the head are the most characteristic peculiarities for both sexes of this species differing it from other Russian representatives of the species-subgroup *attenuatum*. Furthermore, females of *T. beaumonti* differ by distinctly developed lateral angles of clypeus boardering a strongly protruded medial lobe. Males of *T. beaumonti* also differ by genitalia with obtuse preapical lateral angles of penis narrower than preapical hooks, with parameres bilobed apically deeper than the level of penis preapical hooks and with straight apical lobe, and volsellae bearing short marginal bristles.

We suppose, that in this case it is hardly justified to speak about the expansion of the species to the East. Most likely,

researchers simply began to pay attention to the earlier unknown peculiarities, differing *T. beaumonti* from other European members of the species-subgroup *attenuatum*.

Trypoxylon inopinatum Antropov, 1986

Trypoxylon inopinatum Antropov, 1986b, ♂

MATERIAL. RUSSIA: 1♀, Krasnodar reg, Temryuk distr., 2 km SE from vil. Kuchugury, 45.381613°N, 37.022832° E, 16.06. 2014 (Mokrousov) [ZMMU].

DESCRIPTION. **Female** (described for the first time). Head in frontal view rounded, slightly wider than height (74:65). Clypeus with convex basal surface and distinct apical border, bearing a pair of small medial teeth and rounded lateral angles. Supraclypeal sclerite shorter than wide. Supraantennal tubercle tuberiform, with very weak medial carina not reaching its apex, with obtuse-angled transverse apical carina, connected ventrally by a medial carenula between narrow antennal socket rims. Postantennal furrow undeveloped. Front convex, flat-concave medially. Ratio of distances between eyes on vertex and clypeus = 28:20; ratio of distance between eye and ocellus to ocellar diameter and distance between lateral ocelli = 4:5:8. Third antennal segment twice longer its maximum width (11:5). Occipital carina thin, complete circled, divided by distance exceeding foretibial width from hypostomal carina. Pronotal collar twice longer its black posterior band. Scutellum flat-convex. Propodeal dorsal area not enclosed laterally by furrows, with shallow medial furrow (its width is equal to hindocellar diameter); lateral carina distinct, though weak. Hindcoxal organs round, pitshaped, weakly margined posteromedially, placing posteriorly from coxal middle. First abdominal segment clavate, with straight lateral sides, moderately and uniformly widened posteriorly, with ratio of its length to maximum apical width and minimum basal width = 63:21:15. Pygidium uniformly tapered apically, ridgeless.

Front densely punctate (punctures 0.5–1 diameters apart), densely (especially medially) microsculptured, dull. Vertex more delicately punctate, semidull. Scutum like frontal middle densely punctate and microsculptured, dull. Scutellum punctate more delicately than scutum, semidull. Mesopleuron sculptured almost like scutum (punctures 2–4 diameters apart), microsculptured, semidull. Anterior part of metapleuron shiny. Propodeal dorsum completely obliquely striate, with medial furrow transversely carinate. Propodeal hind side delicately transversely rugose. Propodeal lateral sides obliquely densely microstriate and micropunctate, semidull.

Pubescence silvery, short (mainly not longer and only twice longer on clypeus than hindocellar diameter), erect or semierect, most dense on clypeus.

Black; mandibular apical half, palpi, and tibial spurs brown.

Body length 7.0 mm, forewing length 4.5 mm.

DIAGNOSIS. From the ratio of the distance between the eyes at the vertex and at the level of clypeus *T. inopinatum* should be attributed to the species-subgroup *-figulus*, including *T. figulus* (Linnaeus, 1758), *T. medium* de Beaumont, 1945, and *T. minus* de Beaumont, 1945, but differs from these species by the apically bidentate clypeus and by distinctly longer first abdominal segment (ratio of length to maximum width = 3:1 instead of 2–2.5:1 in all the mentioned species). *Trypoxylon inopinatum* also differs from *T. figulus* by smaller body size, by the clypeus without distinct large punctures and by round, pitshaped hindcoxal organs. *T. inopinatum* differs from *T. medium* by the clypeus without long apical projection and with rounded lateral corners. *T. inopinatum* differs from *T. minus* by the absence of a shorn-like hook on the antero-ventral margin of mesopleura. Finally, *T. inopinatum* differs from all members of the species-group *figulus* by the form of the first abdominal segment having almost straight lateral sides weakly and uniformly diverging from the base to apex, instead of concave anteriorly in other species.

DISTRIBUTION. Russia (Krasnodarsky kray: Lazarevskoye, Temryuk).

Trypoxylon koreanum Tsuneki, 1956

Trypoxylon koreanum Tsuneki, 1956, ♂
= *Trypoxylon mowchowense* Tsuneki, 1981a, ♀
= *Trypoxylon okeanskayanum* Tsuneki, 1981a, ♀, ♂

MATERIAL. RUSSIA: 1♀, 3♂♂, Belgorod reg., Belgorod dist., vil. Pulyaevka, 10–12.07.2007 (Potanin) [ZMMU].

DISTRIBUTION. Russia: Primorskiy Kray (Adimi, Okeanskaya, Sutshan, Sedanka, Kongaus, Gornotayozhnoye, Poyma river, Ussuriyskiy reserve, Lazo, Lazovsky reserve, Anisimovka, Barabash-Levada, "Kedrovaya Pad'" reserve), Sakhalin Island. China: Inner Mongolia (Dyn-yuan'-in, N Alashan'); Szechuan (Mowchow); Yunnan. Korea: Seoul.

Trypoxylon koreanum is mentioned from European Russia for the first time.

DISCUSSION. This species was discovered for the first time by V. Gussakovskij [1932] among the materials of the expedition of R. Malaise to the Far East and Kamchatka, but was mistakenly identified as *Trypoxylon varipes* Pérez, 1905. Later, it was mentioned under the same name in the revision of the Palaearctic species of the genus *Trypoxylon* [Gussakovskij, 1936].

Only 20 years later K. Tsuneki has described a separate species on two males from Korea under the name *T. koreanum* and included it into the key of the species from northeastern Asia [Tsuneki, 1956]. After this *T. koreanum* was secondarily discovered in Russian Far East [Kazenas, 1980].

Next year K. Tsuneki has described two similar species — *T. mowchowense* Tsuneki, 1981a from China (Szechuan) and *T. okeanskayanum* Tsuneki, 1981a from the south of Primorskiy Kray. At the same time, *T. koreanum* has not been mentioned in any of his publication untill 1981, when he has published the revision of the species of Japan and north-eastern Asia with additions to his original description of *T. koreanum* from Korea [Tsuneki, 1981b]. But in the generalizing paper, devoted to the "tentative grouping of the *Trypoxylon* species based upon the structure of the male genital organs" [Tsuneki, 1981c] only *T. koreanum* and *T. okeanskayanum* were mentioned as separate species from the species-group *pacificum*, because *T. mowchowense* was described on a female. It may seem strange, but none of the keys published by K. Tsuneki after 1956 includes *T. koreanum*.

Further comparative study of the type series of three mentioned species demonstrated that they were conspecific and the names *T. mowchowense* and *T. okeanskayanum* were synonymized with *T. koreanum* [Antropov, 1986, 1994]. At the same time, the compared materials mentioned by V. Gussakovskij in his revision [Gussakovskij, 1936] with the type specimen of *T. varipes* Pérez, 1905 demonstrated that all the females belonged to *T. koreanum* except the male from Irkutsk which belonged to *T. fronticorne* Gussakovskij, 1936 described in the same revision [Antropov, 1994]. Last specimen was erroneously mentioned as *T. koreanum* by P. Nemkov [2008], who also mentioned *T. koreanum* from Sakhalin Island [Nemkov, 2005] and erroneously from Japan (Honshu) [Nemkov, 2005, 2006, 2009, 2012]. Finally, T. Li & Q. Li [2010] have mentioned *T. koreanum* from southern China (Yunnan).

Finding of this species in European Russia is not unique as it reminds the case with *Crossocerus tyuzendzianus* Tsuneki, 1954, described on Honshu, and later found on Hokkaido [Nambu, 1972], mentioned from Russian Far East [Leclercq, 1988], and even discovered in the Natural-Historical Park "Bitsa forest" in the south-west of Moscow [Antropov, 1993] and later confirmed by the specimens from the National Park "Losinyi Ostrov" in the north-east of Moscow.

Both species are xylobiontes, who build their nests in abandoned borrings of xylophagous insects in dry wood. Both species are relatively small, so that their detection is possible only upon the targeted collecting. We are sure, that in both cases there is no reason to assume disjunctive areals of glacial origin or accidental introduction from Primorskiy Kray with further acclimatization. The most likely cause is insufficient knowledge on the regions of southern Siberia, where finding of such species is possible.

Trypoxylon rubiginosum Gussakovskij, 1936

Trypoxylon rubiginosum Gussakovskij, 1936, ♀
= *Trypoxylon adzharicum* Antropov, 1984, ♂

MATERIAL. RUSSIA: 11♀♀, 5♂♂: Krasnodar reg., Gelendzhik distr., Krinitsa env. 44,400°N 38,316°E, forest stream, 6–13.IX.2009 (K. Tomkovich) [ZMMU].

DISTRIBUTION. Russia (Crimea: Alupka, Sosnovka (Angarskiy pereval), Zaprudnoye, Mezhgor'ye, Crimean reserve; Krasnodar Kray: Sochi, Razdol'noye, Lazarevskoye, Gelendzhik, Krinitsa), Abkhazia (Gagra; Primorskoye), GEORGIA (Batumi, Tbilisi), Azerbaijan (Lenkoran').

DISCUSSION. The species was described on two females from Sochi [Gussakovskij, 1936]. *Trypoxylon adzharicum* Antropov, 1984 which was described later on males from Batumi (Georgia) was proved to be conspecific with *T. rubiginosum*, as it was confirmed by the comparative study of the types and also by direct observations on the nesting activity of *T. rubiginosum* females with subsequent rearing of the specimens of both sexes from the built nests [Antropov, 1989].

Occipital carina forming in its ventral corners a pair of widened flat lobes separated from the posterior surface of the head, and also sexual dimorphism expressed in reddish spots on abdominal tergites II–IV of females in contrast to completely black abdomen of males are the most characteristic peculiarity of this species differing it from other members of the species-group *clavicerum*.

Refferences

Antropov A.V. 1986a. [New and little known sphecid wasps of the Soviet Far East] // Lehr P.A., Belokobylskiy S.A., Storozheva N.A. (eds.). Hymenoptera of East Siberia and the Far East. Academy of Sciences of the USSR, Far-Eastern Scientific Centre, Institute of biology and soil science. Vladivostok. P.81–91 [in Russian].

Antropov A.V. 1986b. [To knowledge of digger wasps from the genus *Trypoxylon* (Hymenoptera, Sphecidae) in the Palearctic fauna] // Zoologicheskiy Zhurnal. Vol.65. No.4. P.624–628 [in Russian].

Antropov A.V. 1989. [To the knowledge of the digger wasps of the tribe Trypoxylini (Hymenoptera, Sphecidae, Larrinae) of the Palearctic fauna] // Byulleten' Moskovskogo Obshchestva Ispytateley Prirody. Otdel Biologicheskiy. Vol. 94. No.1. P.55–58 [in Russian].

Antropov A.V. 1991. [On taxonomic rank of *Trypoxylon attenuatum* Smith (Hymenoptera, Sphecidae)] // Éntomologicheskoye Obozreniye. Vol.70. No.3. P.672–685 [in Russian].

Antropov A.V. 1993. [Notes on three little known Palaearctic species of digger wasps (Hymenoptera, Sphecidae)] // Zoologicheskiy Zhurnal. Vol.72. No.10. P.156–158 [in Russian].

Antropov A.V. 1994. Four new species of the digger wasps genus *Trypoxylon* Latreille (Hymenoptera, Sphecidae) of the Palaearctic and Oriental Regions, with taxonomic notes on some others previously described // Russian Entomological Journal. Vol.3. No.1–2. P.123–133.

Antropov A.V. 2001. Tribu des Trypoxylini // Bitsch J., Dollfuss H., Bouček Z., Schmidt K., Schmid-Egger Ch., Gayubo S.F., Antropov A.V., Y. Barbier. Faune de France. France et régions limitrophes. 86. Hyménoptères Sphecidae d'Europe occidentale. Vol.3. Paris: Fédération Française des Sociétés de Sciences Naturelles. P.347–384.

Bitsch J. 2014. Sphéciformes nouveaux ou peu connus de la faune de France et d'Europe occidentale (Hymenoptera, Aculeata) // Bulletin de la Société Entomologique de France. Vol.119. P.391–419.

Bitsch J., Dollfuss H., Bouèek Z., Schmidt K., Schmid-Egger C., Gayubo S.F., Antropov A.V., Barbier Y. 2001. Faune de France. France et régions limitrophes. 86. Hyménoptères Sphecidae d'Europe occidentale. Vol.3. Paris: Fédération Française des Sociétés de Sciences Naturelles. 459 pp.

Blösch M. 2000. Die Grabwespen Deutschlands. Sphecidae s.str., Crabronidae. Lebensweise, Verhalten, Verbreitung. Die Tierweld Deutschlands. 71. Teil. Keltern: Goecke & Evers. 480 S.

Bohart R.M., Menke A.S. 1976. Sphecid Wasps of the World. A generic revision. Berkeley, Los Angeles, London: University of California Press. 695 pp.

Deván, P. 2004. Kutavky (Sphecidae), hrabavky (Pompilidae), zlatenky (Chrysididae), murarky (Eumenidae) a osy (Vespidae) NPR Tematínska Lesostep, na localite Lúka a v PR Kňaži Vrch (Považský Inovec, Západné Slovensko), získané Malajseho pascou v rokoch 1999 a 2000 // Tutela Naturae. Vol.8. P.143–151.

Dvořák L., Bogusch P., Malenovský I., Bezděčka P., Bezděčková K., Holý K., Liška P., Macek J., Roller L., Říha M., Smetana V., Straka J., Šima P. 2008. Hymenoptera of Hády Hill, near the city of Brno (Czech Republic), collected during the Third Czech-Slovak Hymenoptera meeting // Acta Musei Moraviae, Scientiae biologicae (Brno). Vol.93. P.53–92.

Frommer U. 2009a. Revision und Bestandsaufnahme der Wespenfauna im mittleren Hessen. Teil 1: Grabwespen (Hymenoptera: Ampulicidae, "Crabronidae", Sphecidae s.str.) // Hessische Faunistische Briefe. Bd.27. S.17–59.

Frommer U. 2009b. Die Grabwespe, *Trypoxylon beaumonti* Antropov, 1991 in Deutschland (Hymenoptera: Crabronidae) // Mitteilungen des Internationalen Entomologischen Vereins, e.V. Bd.34. S.41–55.

Frommer U. 2014. Die Stechimmen-Fauna des Oberes Mittelrheintales. Neue Untersuchungen an xerothermen Hanglagen bei Lorch (Hymenoptera: Aculeata) // Hessische Faunistische Briefe. Bd.33. S.13–49.

Gogala A. 2011. Sphecid wasps of Slovenia (Hymenoptera: Ampulicidae, Sphecidae and Crabronidae) // Scopolia. Vol.73. P.1–39.

González J.A., Gayubo S.F., Torres F. 2000. Diversidad y abundancia de esfécidos en una zona pirenaica con influencia mediterránea (Hymenoptera, Sphecidae) // Nouvelle Revue d'Entomologie (Nouvelle Série). Vol.17. P.13–33.

Guéorguiev B.V., Ljubomirov T. 2009. Coleoptera and Hymenoptera (Insecta) from Bulgarian section of Maleshevska Planina Mountain: study of an until recently unknown biodiversity // Acta Zoologica Bulgarica. Vol.61. P.235–276.

Gusenleitner J. 1995. Hymenopterologische Notizen aus Österrreich – 3 (Insecta: Hymenoptera aculeata) // Linzer Biologische Beiträge. Bd.27. Hf.1. S.159–167.

Gussakovskij V.V. 1932. Verzeichnis der von Herrn Dr R. Malaise im Ussuri und Kamtschatka gesammelten aculeaten Hymenopteren // Arkiv för Zoologi, 24A. No.10. P.1–66.

Gussakovskij V.V. 1936. Les espèces paléarctiques du genre *Trypoxylon* Latr. (Hymenoptera, Sphecidae) // Travaux de l'Institut Zoologique de l'Académie des Sciences de l' URSS. Vol.3. P.639–667.

Hua L. 2006. Superfamily Apoidea (Sphecoidea) // L. Hua. List of Chinese insects. Vol. IV. Guangzhou: Sun-Yat-sen University Press. P.274–299.

Jacobs H.J. 2007. Hymenoptera III. Die Grabwespen Deutschlands. Ampulicidae, Sphecidae, Crabronidae. Bestimmungsschlussel // Blank S.M., Taeger A. (eds.). Die Tierwelt Deutschlands begrundet 1925 von Friedrich Dahl. 79. Teil. Keltern: Goecke & Evers. 207 S.

Kazenas V.L. 1980. [Contributions to the digger wasp fauna (Hymenoptera, Sphecidae) of the Soviet Far East] // Lehr P.A. (ed.). Taxonomy of insects of the Far East. Academy of Sciences of USSR, Far-Eastern Scientific Centre. Vladivostok. P.80–94 [in Russian].

Leclercq J. 1988. Crabroniens du genre *Crossocerus* Lepeletier et Brullé trouvés en Sibérie notamment dans le territoire de Primorskii (Hymenoptera Sphecidae Crabroninae) // Bulletin de la Société Royale des Sciences de Liège. Vol.57. No 1. P.15–27.

Li T., Li Q. 2010. The *Trypoxylon* Latreille (Hymenoptera: Crabronidae) of southwest China with descriptions of two new species // Journal of the Kansas Entomological Society. Vol.83. No 3. P.240–247.

Ljubomirov T. 1999. Preliminary studies on the digger wasp fauna (Insecta: Hymenoptera: Sphecidae) in Vitosha Mountain // Acta Zoologica Bulgarica. Vol.51. No 2/3. P.43–60.

Mader M.T., Chalwatzis N. 2000. Die Stechimmen-Fauna (Hymenoptera Aculeata) des Odenwaldes // Hessische Faunistische Briefe. Bd.19. Hf.4. S.50–64.

Mandery K., Kraus M., Voith J., Wickl K.-H, Scheuchl E., Schubert J., Warncke K. 2003. Faunenlist der Bienen und Wespen Bayerns mit Angaben zur Verbreitung und Bestandssituation (Hymenoptera Aculeata) // Beitrage zur bayerischen Entomofaunistik. Bd.5. S.47–98.

Mochi A., Luchetti D. 1994. Brevi riflession sul genere *Trypoxylon* in Italia // Hy-Men. Vol.5. P.15–16.

Nambu T. 1972. Tyûdzendziginguti-o Hokkaido-de saisyû // Life Study (Fukui). Vol.16. P.16.

Negrisolo E. 1995. The aculeate communites (Hymenoptera Aculeata) of two coastal areas of the Veneto region (northeastern Italy) // Lavori. Società Veneziana di Scienze Naturali. Vol.20. P.15–25.

Nemkov P.G. 2005. [Digger wasp fauna (Hymenoptera, Sphecidae, Crabronidae) of Sakhalin Island] // Storozhenko S.Yu. (ed.). Flora and Fauna of Sakhalin Island (Materials of International Sakhalin Project). Part 2. Vladivostok: Dalnauka. P.141–167 [in Russian]

Nemkov P.G. 2006. [Contribution to the fauna of digger wasps (Hymenoptera: Sphecidae, Crabronidae) of Kedrovaya Pad Nature Reserve] // Makarchenko A. (ed.). Flora and Fauna of Kedrovaya Pad Nature Reserve. Vladivostok: Dalnauka. P.166–170 [in Russian]

Nemkov P.G. 2008. [The digger wasp fauna (Hymenoptera: Sphecidae, Crabronidae) of tha Asiatic part of Russia] // A.I. Kurentsov's Annual Memorial Meetings. Vol.19. P.15–34 [in Russian]

Nemkov P.G. 2009. Annotated catalogue of digger wasps (Hymenoptera; Sphecidae, Crabronidae) of Asian part of Russia. Vladivostok: Dalnauka. 193 pp. [In Russian]

Nemkov P.G. 2012. [Section Spheciformes – digger wasps] // Lelej À.S. (ed.). Annotated catalog of of insects of the Far East of Russia. Vol.I. Hymenoptera. Vladivostok: Dalnauka. P.433–447 [in Russian]

Neumeyer R. 2000. Die Stechimmen (Hymenoptera: Aculeata) im Badischen Rangier- und Güterbahnhof in Basel // Mitteilungen der Entomologischen Gesellschaft Basel. Bd.50. Hf.3. S.90–120.

Ohl M. 2001. Sphecidae, pp. 137–143 *in* Dathe H.H., Taeger A., Blank S.M. (eds). Entomofauna Germanica. Band 4. Verzeichnis der Hautflügler Deutschlands. Entomologische Nachrichten und Berichte, Beiheft 7. 178 S.

Pagliano G. 1994. Distribution records on three species of *Trypoxylon* in Italy // Hy-Men. Vol.5. P.16.

Pagliano G. 2009. Segnalazioni inedited di Sphecidae (Hymenoptera) per il Piemonte e alter regioni italiane // Rivista Piemontese di Storia Naturale. Vol.30. P.173–192.

Pagliano G., Negrisolo E. 2005. Fauna d'Italia. Hymenoptera Sphecidae. Bologna: Edizioni Calderini. 559 pp.

Pagliano G., Scaramozzino P.L. 1999. Fauna imenotterologica delle Langhe. Oasi xerotermica di Borgomale (Nota faunistica III) // Rivista Piemontese di Storia Naturale. Vol.20. P.139–192.

Paik W.-H. 1985. Key to the Sphecidae (Hymenoptera) of Korea. Da Han Min Guo. Sue Shu Yuan Lun Wen Ji // Zi Ran Ke Xue Pian. Vol.24. P.189–231.

Schmid-Egger C. 1994. Die faunistische Bedeutung alter Weinberge am Beispiel der Stechimmen (Hymenoptera, Aculeata) des Höllenberges bei Grünstadt // Fauna und Flora in Rheinland-Pfalz. Zeitschrift für Naturschutz. Bd.7. S.673–707.

Schmid-Egger C. 1995. Die Eignung von Stechimmen (Hymenoptera: Aculeata) zur naturschutzfachlichen Bewertung am Beispiel der Weinberglandschaft im Enztal und im Stromberg (nordwestliches Baden-Württemberg). Göttingen: Cuvillier Verlag. 235 S.

Schmid-Egger C. 2000. Die Wildbienen- und Wespenfauna der oberrheinischen Trockenaue in südwestlichen Baden-Württemberg (Hymenoptera: Aculeata; Evanioidea), pp. 257-306 *in* Landesanstalt für Umweltschutz (editor). Vom Wildstrom zur Trockenaue. Natur und Geschichte der Flusslandschaft am südlichen Oberrhein. Ubstadt-Weiher: Verlag Regionalkultur. 496 S.

Schmid-Egger C. 2001. Die Stechimmenfauna des Blllenbergs in Südelsass (Hymenoptera, Aculeata) // bembiX. Bd.14. S.9–22.

Schmid-Egger C. 2010. Rote Liste der Wespen Deutschlands. Hymenoptera Aculeata: Grabwespen (Ampulicidae, Crabronidae, Sphecidae), Wegwespen (Pompilidae), Goldwespen (Chrydididae), Faltenwespen (Vespidae), Spinnenameisen (Mutillidae), Dolchwespen (Scoliidae), Rollwespen (Tiphiidae) und Keulhornwespen (Sapygidae) // Ampulex. Hf.1. S.5–39.

Schmid-Egger C. 2011. Hymenoptera Aculeata from "Parc national du Mercantour" (France) and "Parco delle Alpi Marittime" (Italy) in the south-western Alps // Ampulex. Hf.3. S.13–50.

Schmid-Egger C., Risch S., Niehuis O. 1995. Die Wildbienen und Wespen in Rheinland-Pfalz (Hymenoptera, Aculeata). Verbreitung, Ökologie und Gefährdungsituation. Fauna und Flora in Rheinland-Pfalz // Zeitschrift für Naturschutz. Beiheft. Bd.16. S.1–296.

Schmid-Egger C., Schmidt K., Doczkal D. 1996. Rote Liste der Grabwespen Baden-Württembergs (Hymenoptera: Sphecidae) // Natur und Landschaft. Bd.71. S.371–380.

Schmidt K., Schmid-Egger C. 1997. Kritisches Verzeichnis der deutschen Grabwespenarten (Hymenoptera, Sphecidae) // Mitteilungen der Arbeitsgemeinschaft Ostwestfälisch-Lippischer Entomologen. Bd.13. S.1–35.

Schmidt K., Schmid-Egger C., Doczkal D. 1995. Bearbeitung unklarer mitteleuropäischer Grabwespentaxa // bembiX. Hf.4. S.7–9.

Standfuss K., Standfuss L. 2006. Zum aktuellen Artenbestand der Astatinae, Larrinae, Crabroninae und Philanthinae (Hymenoptera: Crabronidae p.p.) der planar-kollinen Vegetationsstufe in Südost Thessalien / Griechenland // Entomofauna. Bd.27. Hf.7. S.93–104.

Standfuss K., Standfuss L. 2012. Weitere Nachweise van Grabwespen und solitären Faltenwespen (Hymenoptera: Ampulicidae, Crabronidae, Sphecidae; Eumenidae) in Südost-Thessalien/Griechenland // Entomofauna. Bd.33. S.425–431.

Strumia F., Pagliano G., Gayubo S.F. 2012. Hymenoptera Spheciformes observed in San Rossore Reserve (Pisa Province, Tuscany, Italy) // Atti della Società Toscana di Scienze Naturali. Memorie (Serie B). Vol.119. P.55–60.

Tischendorf S., Frommer U., Flügel H.-J. 2011. Kommentierte Rote Liste der Grabwespen Hessens (Hymenoptera: Crabronidae, Ampulicidae, Sphecidae) – Artenliste, Verbreitung, Gefährdung. Hessische Ministerium für Umwelt, Energie, Landwirtschaft und Verbraucherschutz. Wiesbaden. 240 S.

Tormos J., Asís J.D., Gayubo S.F., Calvo J., Martin M.A. 2005. Ecology of crabronids wasps found in trap nests from Spain (Hymenoptera: Spheciformes) // Florida Entomologist. Vol.88. No.3. P.278–284.

Tormos J., Asís J.D., Gayubo S.F., Mingo E. 1996. Description of the mature larvae of *Chrysis gracillima* and *Omalus biaccinctus* and new data on the biology of *Trichrysis cyanea* (Hymenoptera: Chrysididae) // Florida Entomologist. Vol.79. No.1. P.56–63.

Tsuneki K. 1954. Descriptions and records of wasps of the families Chrysididae and Sphecidae of Japan (Hymenoptera) // Memoirs

of the Faculty of Liberal Arts, Fukui University. Series II, Natural Science. No.4. Pt.5. P.37–54.

Tsuneki K. 1956. Die Trypoxylonen der nordöstlichen Gebiete Asiens (Hymenoptera, Sphecidae, Trypoxyloninae) // Memoirs of the Faculty of Liberal Arts, Fukui University. Series II, Natural Science. No.6. Pt.1. P.1–42.

Tsuneki K. 1981a. Studies on the genus *Trypoxylon* Latreille of the Oriental and Australian Regions (Hymenoptera, Sphecidae). XI. Additional species from various parts of the Regions, with an appendix on some species from other Regions // Special Publications of the Japan Hymenopterists Association. No.16. P.1–90.

Tsuneki K. 1981b. Revision of the *Trypoxylon* species of Japan and northeastern part of Asiatic continent, with comments on some species of Europe (Hymenoptera, Sphecidae) // Special Publications of the Japan Hymenopterists Association. No.17. P.1–92.

Tsuneki K. 1981c. Tentative grouping of the *Trypoxylon* species based upon the structure of the male genital organs with appendix of the distribution table (Hymenoptera, Sphecidae) // Special Publications of the Japan Hymenopterists Association. No.18. P.1–100.

Vago J.-L. 2007. Les Hyménoptères vespiformis (Hymenoptera Tiphiidae, Mutillidae, Scoliidae, Sapygidae, Vespidae, Eumenidae, Pompilidae et Sphecidae) du Nord de la France, un patrimoine à preserver // Le Héron. Vol.40. P.173–180.

van der Smissen J. 2010. Beitrag zur Stechimmenfauna Südfrankreichs (Ardèche, Drôme, Gard, Vaucluse) (Hymenoptera Aculeata: Apidae, Chrysididae, Scoliidae, Vespidae, Pompilidae, Sphecidae) // van der Smissen J. Bilanz aus 20 Jahren entomologischer Aktivitäten (1987–2007) (Hymenoptera Aculeata). Verhandlungen des Vereins für Naturwissenschaftliche Heimatforschung zu Hamburg e.V. Bd.43. S.355–388.

Vepřek D., Straka J. 2007. Apoidea: Spheciformes (kutilky) // Bogusch P., Straka J., Kment P. (eds). Annotated checklist of the Aculeata (Hymenoptera) of the Czech Republic and Slovakia. Acta Entomologica Musei Nationalis Pragae. Suppl. Vol.11. P.191–239.

Zettel H., Ockermüller E., Wiesbauer H. 2014. Weitere interessante Funde von Grabwespen (Hymenoptera: Sphecidae, Crabronidae) aus Wien und Niederöstereich // Beiträge zur Entomofaunistik. Bd14. S.159–175.

Zettel H., Zimmermann D., Wiesbauer H. 2013. Die Bienen und Grabwespen (Hymenoptera: Apoidea) im Donaupark in Wien (Österreich) // Sabulosi (Beiträge zur Hymenopterologie). Bd.3. S.1–23.