NEW SPECIES AND A KEY TO NORTH AMERICAN *SOLIERELLA* IN THE *INERMIS* GROUP (HYMENOPTERA: SPHECIDAE: LARRINAE: MISCOPHINI)*

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The *inermis* group of *Solierella* is named after the first known North American species, *"Nysson? inerme"* Cresson 1872, and is distinguished by the forewing venation. In addition to the petiolate forewing second submarginal cell common to the tribe, the second recurrent vein curves sharply backward to end at about the middle of the second submarginal cell (fig. 23). Also, males of North American species have a bi-colored antenna: black marked with orange, yellow or whitish (figs. 1–16). The extent of the pale antennal markings in the male, together with conformation of the clypeus, are species diagnostic. On the other hand, female characters are few and determinations are best made by association with males. Female characters of some value lie in the clypeus, vertex, and ridging laterally on the propodeum.

A summary of group characters is given below in order to simplify descriptions of the 10 new species. The total number of known species of this group from North America is now 16. Additional ones will likely be found, and several more occur in South America. Most of those from the latter area appear to have the male antenna all dark or nearly so.

Curators or Collection Managers of several institutions have been particularly helpful in the present study. These are: R. W. Brooks, University of Kansas; J. A. Chemsak, University of California, Berkeley; S. I. Frommer, University of California, Riverside; T. Griswold, Utah State University (USDA); E. R. Hoebeke, Cornell University; A. W. Hook, St. Edwards University, Austin, Texas; L. S. Kimsey, University of California, DAVIS; L. Masner, Canadian National Collection; A. S. Menke, U.S. National Museum; W. J. Pulawski, California Academy of Sciences, SAN FRANCISCO; E.

**Manuscript received by the editor August 6, 1990.*

G. Riley, Texas A&M University; R. R. Snelling, Los Angeles County Museum; and M. Wasbauer, California State Department of Agriculture. Holotype depositories are indicated above in capital letters. Paratypes will be distributed as far as possible.

Technical abbreviations used in the key and descriptions are: F-I, F-II, etc., flagellomeres; T-I, tergum of basal gastral segment.

Solierella Spinola. Type species, *S. miscophoides* Spinola.

Solierella inermis group (of North America).

Group characters:

Ivory-white markings as follows: male mandible except near base (female mandible may be all dark), 2 transverse spots on pronotal ridge, spot on pronotal lobe, tegula, basal wing sclerite, scutellum, large apicoventral spots on forefemur and midfemur, apical dot on hindfemur, outer posterior stripe on tibiae, male tarsomeres I–III or IV. Fine, appressed silvery pubescence most noticeable on face below frontal V, terga, and mesopleuron. Frons finely and closely punctate, mesopleuron finely granulose, propodeal enclosure well margined by a lateral groove. Male antenna unevenly swollen and (in North America) bicolored (figs. 1–16); female antenna with F-I-III each about 1.3× as long as broad; mandible without ventral tooth or step; clypeus usually with 3 longitudinal ridges, central one strongest and reaching base (figs. 19, 20, 22); ocellar triangle very slightly broader than long; raised frontal V well developed, subcarinate, angled at 45°–50°; pronotal ridge smoothly rounded; forewing marginal cell rounded distally, second submarginal cell nearly equilateral, second recurrent vein strongly recurved and ending near middle of second submarginal cell (fig. 23); male forecoxa expanded laterally and with an inner posterior pair of setae; male foretrochanter emarginate beneath and swollen toward apex which bears a seta; no foreleg rake; hindcoxa with a small inner basal spine; T-I somewhat constricted basally.

Key to males of North American species of *Solierella* in the *inermis* group

1. Vertex with a swelling behind each lateral ocellus (fig. 24), clypeal apex wedgelike (as in fig. 20), F-I-II or III dark, F-XI as long as 3.5–3.8 preceding articles together .... *menkei* Bohart
   Vertex without swellings, other characters various 2

2. Clypeal apex broadly rounded truncate, ecarinate (fig. 21); F-IX-X orange, F-XI dark and as long as 6 of the short preceding articles together (fig. 6) ..... *sonorana* Bohart
   Clypeal apex narrow, truncate, bidentate, or tridentate, at least a partial median carina present, flagellum various 3
3. F-VI-VII forming a complete pale ring, VII partly dark above, other articles of unusually slender flagellum dark, F-XI as long as 3.5 to 4 preceding articles together (fig. 7) .... *cingulis* Bohart
   F-VI-VII not forming a narrow pale ring, other characters various 4
4. F-XI relatively long, at least slightly longer than 4 preceding articles together (figs. 8, 13, 16) 5
   F-XI relatively short to medium, at least slightly shorter than 4 preceding articles together (figs. 1–5, 9–12, 15) 8
5. F-V-VIII whitish in front, F-I-III and F-X-XI mostly or all dark, F-XI as long as 4 preceding articles together (fig. 16) ..... *hooki* Bohart
   F-V-VIII not whitish in front, F-I-IV (at least) pale reddish in front, other characters various 6
6. Pedicel reddish yellow above (fig. 13), F-I-IV unusually short and broad, clypeal apex nearly equally tridentate .... *mirifica* Pate
   Pedicel all dark, F-I-IV not unusually short and broad, clypeal apex various 7
7. Clypeal apex with 3 small and evenly advanced teeth; flagellum rather strongly swollen, F-V 2× as broad as long in dorsal view ..... *napa* Bohart
   Clypeal apex with a sharp median tooth and less advanced, downcurved submedian teeth; flagellum moderately swollen, F-V 1.5× as broad as long in dorsal view .. *apache* Bohart
8. F-XI shorter than 3 preceding articles together, usually equal to 2.5 or less (figs. 1, 2, 3, 9) 9
   F-XI at least as long as 3 preceding articles together (figs. 4, 5, 11, 12, 15) 12
9. Clypeal tip wedgelike, with median tooth clearly more extended than submedian ones (fig. 20); flagellum considerably orange dorsally 10
   Clypeal tip truncate or nearly so, flagellum all or mostly dark dorsally 11

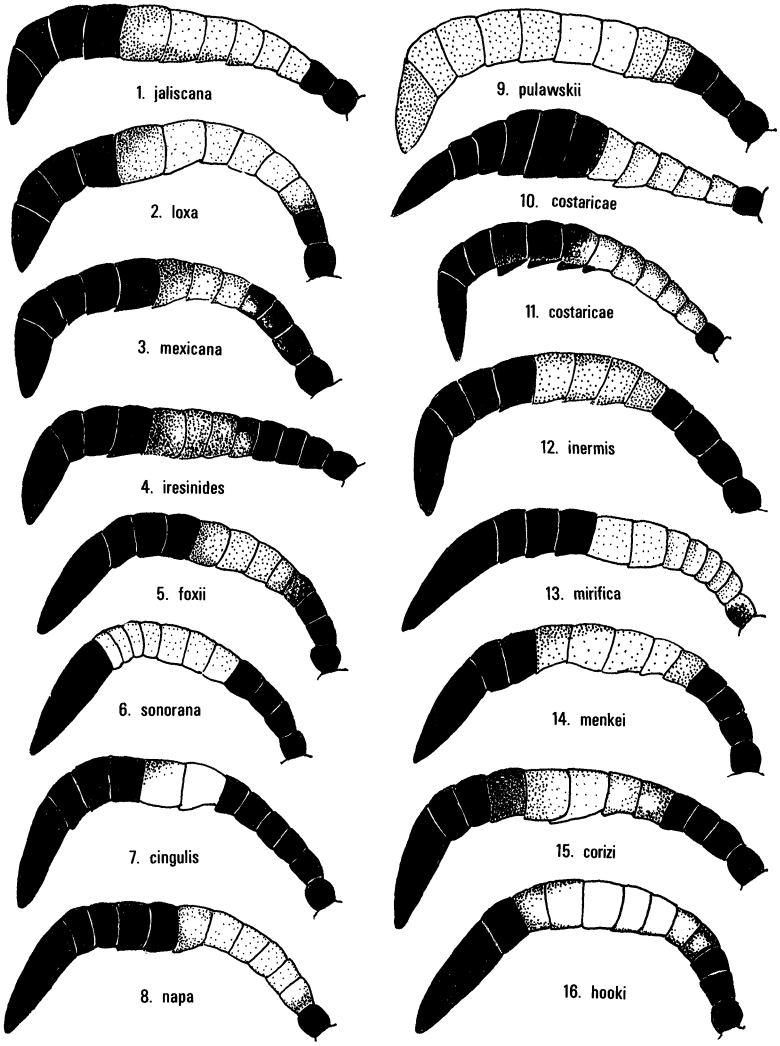
10. F-II-VII at least partly orange in front, F-VIII-XI black (fig. 2) ..... *loxa* Bohart
    F-II and sometimes III dark in front, F-IV-X light to dark orange in front (fig. 9) ..... *pulawskii* Bohart
11. Clypeal tip truncate (fig. 17), flagellum moderately expanded beyond middle, F-III-V with yellow spots in front, F-II and VII sometimes a little yellow (fig. 3) .. *mexicana* (Rohwer)
    Clypeal tip with 3 weak but distinct and equally advanced teeth (fig. 19); flagellum strongly expanded beyond middle (fig. 1), F-II-VII at least partly orange in front .... *jaliscana* Bohart
12. Clypeal apex without distinct teeth (fig. 18) 13
    Clypeal apex with 3 distinct teeth as in fig. 19 or fig. 20 14
13. F-I-II whitish yellow in front (fig. 11), flagellum strongly expanded medially (fig. 10), clypeal apex truncate or a little concave ..... *costaricae* Bohart
    F-I-II and often F-III dark in front (fig. 12), flagellum moderately swollen medially, clypeal apex polished and slightly convex ..... *inermis* (Cresson)
14. Clypeal apex wedgeshaped, median tooth advanced in front of submedian ones (as in fig. 20), flagellum moderately swollen toward middle, nearly all dark dorsally, F-IV-VII dull orange in front view ..... *foxii* (Viereck)
    Clypeal apex with 3 nearly equal teeth (as in fig. 19), flagellum strongly swollen toward middle, not nearly all dark dorsally 15
15. F-IV-VII with yellowish white in front view (fig. 15) .... *corizi* Williams
    F-IV-VII obscurely orange in front view (fig. 4) .... *iresinides* (Rohwer)

Solierella apache Bohart, new species

Holotype male. Length 4 mm; flagellum swelling moderately beyond F-IV, pale orange on F-I-V and half of VI, black on rest except F-XI which is orange; F-XI as long as 5 preceding articles together; clypeus with midtooth sharp and projecting over downcurved submedian ones; vertex and scutum with close punctation,

postocellar transverse groove hardly visible; forecoxa blunt laterally, propodeal enclosure finely sculptured, propodeal side without discernible microridging.

Female. Unknown.



Figs. 1–16, male pedicel and flagellum, front view. Patterns illustrated, figures not proportional.

Holotype male (SAN FRANCISCO), 4.5 mi se. Apache, Pinal Co., Arizona, IV-6-59, on *Euphorbia* mat (P. H. Timberlake).

The moderately swollen flagellum which is orange basally and apically, the unusually long F-XI, and the sharp clypeal midtooth are distinctive.

Solierella cingulis Bohart, new species

Holotype male. Length 4.5 mm; flagellum swelling gradually beyond F-IV, a cream colored ring covering F-VI and most of VII, other articles dark, F-XI as long as 3.5 preceding articles together (fig. 7); clypeus with midtooth a little more advanced than submedian ones; vertex and scutum with moderately close punctation but somewhat shiny; postocellar transverse groove present; forecoxa bluntly pointed laterally; propodeal enclosure granulate-recticulate with a few weak longitudinal carinae, side very finely and closely ridged.

Female. Length about 5.5 mm; flagellum black, mandible with a median white spot, clypeal lip small and narrow; facial pubescence silvery, vertex simple, propodeal side with fine but distinct ridges, hindtarsal I black. Description based on 7 females.

Holotype male (DAVIS), 5 mi w. Portal, Cochise Co., Arizona, IX-17-78 (R. C. Miller). Paratypes, 13 males, 7 females, ARIZONA: near Portal, Superior, Madera Canyon, Fort Huachuca, Peña Blanca, Sabino Canyon; NEW MEXICO: 18 mi n. Rodeo; TEXAS: Austin, Holland.

The slender male antenna with a pale ring around flagellomeres VI and VII is distinctive. F-V is sometimes a little lighter than F-IV.

Solierella costaricae Bohart, new species

Holotype male. Length 5 mm; flagellum swelling abruptly and extensively from F-V to F-IX, a brownish yellow ring on F-I to F-V, continued in front onto F-VI and F-VII, rest black except more brown on IX to XI in front, F-XI nearly as long as 3 preceding articles together (fig. 11); clypeal apex rather sharply truncate (fig. 18), occipital carina prominent laterally; facial pubescence a little golden; vertex and scutum closely punctate, dull; forecoxa quite sharp and curved laterally; propodeal enclosure finely reticulate, propodeal side very finely and closely ridged.

Female. Length about 6 mm, flagellum black; mandible partly white, clypeal lip blunt and reddish, facial pubescence silvery, vertex simple, propodeal side finely ridged in lower two-thirds, hindtarsal I dark. Description based on 11 females.

Holotype male (DAVIS), Rio Corbici near Las Cañas, Guanacaste, Costa Rica, III-8-76 (R. M. Bohart). Paratypes, 29 males, 5 females, same data as holotype. Other specimens, 7 males, 3 females, COSTA RICA: Junquillal Beach in Guanacaste, 24 km nw. Cañas, 9 km sw. Cañas, Quepos, Bebedero, February, March, May; 1 male, EL SALVADOR: Quezaltepeque, VIII-6-63.

The male flagellum is unusually swollen, and the orange to whitish yellow coloration extends in front from F-I to VI (fig. 11). The antenna is broadest at F-VI-VII which together form a flat, silvery, reflective, ventral plate. This reflective area occurs in some other species, particularly *jaliscana,* but is less well developed. The greatly swollen flagellum (fig. 10) together with the reddish and truncate clypeal apex of the male are recognition characters.

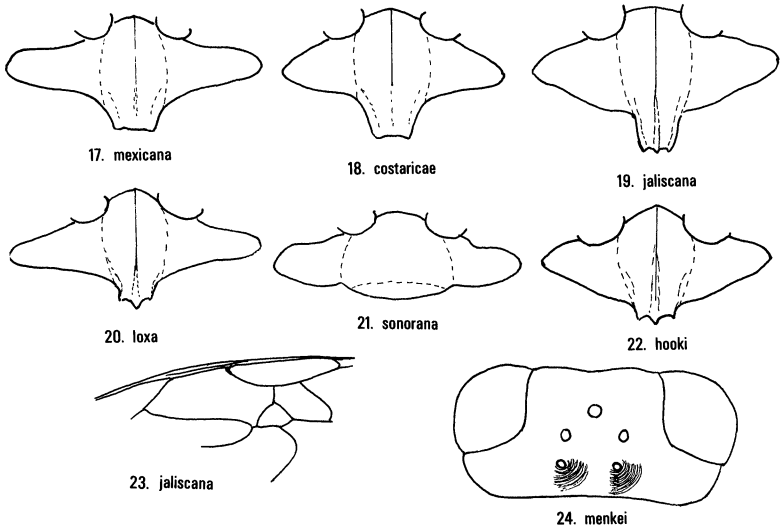
Solierella hooki Bohart, new species

Holotype male. Length 5 mm, flagellum swelling gradually beyond F-III, widest at F-VII, white in front on F-V to VIII, F-XI as long as 4 preceding articles together (fig. 16); clypeal apex with middle tooth sharp and more advanced than submedian ones (fig. 22); postocellar transverse groove present; vertex and scutum a little shiny; forecoxa acutely angled laterally; propodeal enclosure roughly ridged, propodeal side with very fine ridging.

Female. Length 5.5 mm, flagellum black, mandible with medial half white, clypeal lip well developed, facial pubescence silvery, vertex simple, propodeal side finely ridged. Description based on 5 topotypical females.

Holotype male (DAVIS), Austin, Travis Co., Texas, May 20, 1988 (A. Hook). Paratypes, TEXAS: 1 male, 5 females, topotypical, April, May, October (A. Hook); 1 male: Lake Brownwood State Park, Brown Co., V-7-86 (W. J. Pulawski).

Characteristic in the male is the gradually swollen flagellum which is white in front from F-V to VIII. Also, F-XI is unusually long, and the narrow clypeal apex has 3 sharp teeth with the middle one most extended. The species is named for the wasp biologist, Allan Hook.



Figs. 17–24, male clypeus, front view; fig. 23, male forewing venation in area of submarginal cells; fig. 24, male head, dorsal, to show postocular tubercles.

Solierella jaliscana Bohart, new species

Holotype male. Length 5.5 mm; flagellum swelling gradually but extensively beyond F-I, widest at F-VII, yellowish in front on F-II to F-VI and base of VII, F-XI as long as 2 preceding articles together (fig. 1); clypeal apex protruding with 3 equally advanced weak teeth (fig. 19); facial pubescence a little golden above; vertex and scutum rather shiny; forecoxa bluntly rounded laterally; propodeal enclosure reticulate and with some 12 longitudinal carinae, propodeal side rather closely and finely ridged.

Female. Length 6 mm, flagellum with F-IV-V a little brownish orange in front, mandible black and red, clypeal lip well developed, and apex rounded, facial pubescence silvery, vertex simple, propodeal side finely ridged on lower two-thirds, hindtarsal I dark. Description based on 6 females.

Holotype male (DAVIS), Ixtlahuacan, Jalisco, Mexico, IX-17-70 (R. M. Bohart). Paratypes, 9 males, 6 females (all from Mexico): JALISCO; 15 mi ne. Guadalajara, Plan de Barrancas; SINALOA: 3 mi n. Elota; DURANGO: 4 mi n. Nombre de Dios; MORELOS: Temixco;

PUEBLA: Petlalcingo; OAXACA: El Cameron; CHIAPAS: Ixtapa.

The combination of a short F-XI, extended clypeal apex with 3 equal teeth, and the strongly swollen flagellum with F-II-VI orange in front characterize the male of this species. At least some females have F-IV-V brownish orange in front.

Solierella loxa Bohart, new species

Holotype male. Length 5 mm, flagellum swelling moderately beyond F-II, widest at F-VII, yellowish in front on F-II to F-VI and base of VII, F-XI nearly as long as 2 preceding articles together (fig. 2); clypeal apex wedge shaped (fig. 20); postocellar transverse groove present; vertex and scutum rather shiny; forecoxa narrowly rounded laterally; propodeal enclosure finely reticulate, obscurely ridged; propodeal side closely and finely ridged.

Female. Length 6 mm, flagellum with F-III and F-IV brownish orange in front, mandible more than half white, clypeal lip narrow and apex rounded, facial pubescence silvery, vertex simple, propodeal side with fine but distinct ridging, hindtarsal I dark. Description based on 3 females.

Holotype male (DAVIS), Tanbark Flat, San Gabriel Mts., Los Angeles Co., California, VII-10-56 (R. M. Bohart). Paratypes, 3 males, 3 females, CALIFORNIA: Tanbark Flat, Redding, Junction City, 9 mi w. Beaumont.

F-XI of the male is unusually short but in some paratypes it is as long as 2.5 preceding articles together. The wedgelike clypeal tip and distinctive antennal coloration are useful key characteristics.

Solierella menkei Bohart, new species

Holotype male. Length 5.5 mm, flagellum gradually and rather weakly swollen beyond F-IV, widest at F-VII, yellowish in front on F-IV to F-VII, F-XI as long as preceding 3.5 articles together (fig. 14); clypeal apex with 3 nearly equally advanced denticles; postocellar transverse groove present; vertex polished and weakly punctate, a shiny and knoblike swelling behind each ocellus (fig. 24), scutum somewhat shiny; forecoxa produced laterally into a blunt point; propodeal enclosure irregularly and roughly ridged, propodeal side distinctly ridged.

Female. Length 5.5–6.5 mm, flagellum black, mandible black and red, clypeal lip well developed, apex moderately broad and

rounded, facial pubescence silvery, vertex with a swelling behind each hindocellus (as in fig. 24), propodeal side rather coarsely ridged, hindtarsal I usually dark. Description based on 113 females.

Holotype male (DAVIS), 18 mi. n. Rodeo, Hidalgo Co., New Mexico, IX-7-76 (R. M. Bohart). Paratypes, 116 males, 112 females, CALIFORNIA: 6 mi e. Mendota, Big Pine, Deep Springs (Inyo Co.), Santa Ana Canyon and Peters Canyon (Orange Co.), Irvine Park and Newport Beach (Orange Co.), Ash Mt. (Tulare Co.), Hallelujah Junction (Lassen Co.), Tanbark Flat and Tapia Park (Los Angeles Co.), Pine Canyon (Los Angeles Co.), Warner Springs (San Diego Co.), Chula Vista, La Mesa, Riverside, 18 mi w. Blythe, Coachella; ARIZONA: Kingman, 10 mi nw. Congress, Buckeye, Roper Lake (Graham Co.), 20 mi e. Gila Bend, 15 mi n. Yuma, Quartzite, Silver Bell Fajada and Madera Canyon (Pima Co.), Maricopa Co., Tucson, 7 mi s. Safford, 14 mi w. Tombstone, Portal; NEW MEXICO: 18 mi w. Rodeo, Las Cruces, Tucumcari, Sumner Lake (de Baca Co.), Valley of Fires (Lincoln Co.); NEVADA: Tule Desert and Garden Wash (Lincoln Co.), Beowawe, Valmy, Winnemucca, Warm Springs (Nye Co.); IDAHO: Gooding Co., Selander Park (Bonneville Co.); UTAH: Delta; TEXAS: Kimble Co., Brown Co., Zapata Co., Hidalgo Co., Webb Co., Llano Co., Cameron Co., Starr Co., Blanco Co.; following States of Mexico: CHIHUAHUA: 9 mi s. Hidalgo de Parral; HIDALGO: 5 mi s. Sabinas; ZACATECAS: 9 mi n. Ojo Caliente; TAMAULIPAS: 80 mi se. Matamoros; BAJA CALIFORNIA: Santa Rosallilita; BAJA CALIFORNIA SUR: 4.5 mi sw. Miraflores, Los Barriles.

This is the most abundant and widespread species in the group. The vertex tubercles are unique (fig. 24). Usually, they are well defined but in a few females they may be rather low. In the male additional characters are the nearly equally tridentate clypeal tip, and dark base (I-II or I-III) of the flagellum. The female mandible seems always to be black and red. The species is named for the well-known hymenopterist, my friend Arnold Menke. Many of the Nevada specimens, such as those from Tule Desert and Garden Wash, were collected in ethylene glycol pan traps by R. C. Bechtel and J. B. Knight.

Solierella napa Bohart, new species

Holotype male. Length 5 mm; flagellum swelling moderately beyond F-III, widest at F-VII, yellowish in front on F-II to VI and

base of VII, F-XI a little longer than 4 preceding articles together (fig. 8), clypeal apex with 3 equally advanced denticles; vertex and scutum rather shiny; forecoxa bluntly pointed laterally; propodeal enclosure irregularly reticulate, propodeal side finely ridged.

Female. Length 6 mm, flagellum black, mandible black and reddish yellow or yellow and reddish, clypeal lip well developed but medially carinate and a little pointed, facial pubescence silvery, vertex simple, propodeal side rather coarsely ridged. Description based on 4 females.

Holotype male (DAVIS) Samuel Springs (now Berryessa Lake), Napa Co., California, V-9-55 (R. M. Bohart). Paratypes, 6 males, 4 females, CALIFORNIA: 4 mi nw. Berryessa (Napa Co.), Capay, Pillsbury Lake and Borax Lake (Lake Co.), Del Puerto Canyon (Stanislaus Co.), Fawn Lodge (Trinity Co.); male, UTAH: 25 mi s. Moab.

In the male the long F-XI, yellow-marked F-II to VI in front, and the equally tridentate clypeal apex are recognition characters.

Solierella pulawskii Bohart, new species

Holotype male. Length 5 mm; flagellum swelling moderately beyond F-III, widest at F-VII, yellowish to orange in front on F-III to F-X, F-VI and VII somewhat whitish, F-XI brown and about as long as 2 preceding articles together (fig. 9); clypeal apex polished and wedge shaped; postocellar transverse groove present; vertex and scutum rather shiny; forecoxa weakly pointed laterally; propodeal enclosure reticulate and obscurely ridged, propodeal side finely and closely but distinctly ridged.

Female. Length 5.5 mm, flagellum black, mandible with a large whitish spot, clypeal lip narrow, slightly pointed, facial pubescence silvery, vertex simple, propodeal side rather coarsely ridged. Description based on 1 female.

Holotype male (SAN FRANCISCO), Fort Lancaster State Park, Crockett Co., Texas, June 21, 1983 (W. J. Pulawski). Paratypes, TEXAS: 2 males, 1 female, same data as holotype; 2 males, Pedernales Falls, Blanco Co., April, May (J. L. Neff, A. Hook); 1 male, Hidalgo Co., VII-30-28 (R. H. Beamer). Male paratype, COAHUILA: 20 mi s. Piedras Negras, VIII-10-58 (A. S. Menke, L. A. Stange)

Recognition characters in the male are the short F-XI, dark F-I-II, yellowish orange in front on F-III to X, and the wedgelike clypeal

apex. The species is named for the well known researcher and collector in Hymenoptera, my friend, Wojciech Pulawski.

Solierella sonorana Bohart, new species

Holotype male. Length 3.5 mm; flagellum relatively slender, expanding evenly beyond F-II, widest at F-X or XI, orange in front on F-IV to F-X, XI black and as long as 6 shortened preceding articles together (fig. 6); clypeus with median section ecarinate, apex broadly rounded truncate and with a smooth lip (fig. 21); vertex dull, scutum rather shiny, forecoxa bluntly rounded laterally, intercoxal setae unusually long; propodeal enclosure finely granulose, propodeal side with close and almost imperceptible microridging.

Female. Unknown.

Holotype male (DAVIS), Belem, Sonora, Mexico, IX-4-70 (G. E. and R. M. Bohart).

This is the smallest known species of the group. It is unique in its ecarinate clypeus, with apex broadly rounded. The flagellum is odd, also, with F-IV to X orange in front but F-XI black. F-VI to F-X are unusually short.

Summary

Males of North American *Solierella* related to *inermis* (Cresson) are remarkable in having the antenna bicolored and more or less swollen toward the middle. Ten new species, based especially on male characters, are proposed. These are *apache* (southern California), *cingulis* (western U.S.), *costaricae* (Costa Rica and el Salvador), *hooki* (Texas), *jaliscana* (Mexico), *loxa* (California), *menkei* (western U.S. and Mexico), *napa* (northern California and Utah), *pulawskii* (Texas and Coahuila), and *sonorana* (Sonora). A key is given to the 16 species now known from America north of Panama.