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NOTES ON NORTH AMERICAN *STIGMUS* PANZER (HYMENOPTERA, SPHECOIDEA)

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The following notes on the North American wasps of the pemphredonid genus *Stigmus* Panzer are published at this time so that two new taxa, some new synonyms and new status for a few taxa will be available for the forthcoming revised edition of the Catalog of Hymenoptera North of Mexico. A provisional key is included for the taxa occurring north of Mexico.

Pate (1937a:92) recognized two subgenera, *Stigmus* sens. str. and *Gonostigmus* Rohwer, in his generic reclassification of this group. I am synonymizing *Gonostigmus* herein, but I am describing a new subgenus, *Atopostigmus*, for *fulvipes* Fox. A third subgenus, *Carinostigmus* Tsuneki, has been recorded from the Palaearctic, Oriental and Ethiopian regions; so far as known it has no representatives in the New World. The tridentate mandibles of the females of typical *Stigmus* and of *Carinostigmus* separate those two subgenera at once from *Atopostigmus* which has bidentate mandibles in the female.

Neither *pendulus* Panzer nor *solskyi* Morawitz, the common European twig- and cane-nesting *Stigmus* have been collected in North America. This is odd because other European species having similar nesting habits, such as *Passaloecus insignis* van der Linden, are adventive in North America.

The North American species of typical *Stigmus* may be separated into two weakly defined species groups based on clypeal characters of the female. The Pendulus Group has the clypeus highly polished with very sparse punctures bearing fine, suberect, cinereous setae. The North American rep-

resentatives are *fraternus* Say, *americanus* Packard and *fulvicornis* Rohwer; I have examined the following Palaearctic members—*pendulus* Panz., *solskyi* Mor., *quadriceps* Tsun. and *convergens* Tsun. The Inordinatus Group has the clypeal surface less shiny with denser punctures bearing coarser, decumbent, silvery setae which are frequently dense enough to obscure the basic sculpture. Its North American representatives are *inordinatus* Fox, *podagricus* Kohl, *hubbardi* Roh. and *aphidiperda* Roh.; the Antillean *thoracicus* Ashmead and Central American *temporalis* Kohl also belong here; I have seen no Palaearctic members, but judged from Tsuneki (1954: fig. 37) *verhoeffi* Tsun. apparently belongs here.

North American species of the typical subgenus nest in wood in some form or another. Reported nesting sites include: Abandoned borings of other insects, principally beetle larvae, in twigs, dead trees, structural lumber or furniture (*fraternus, americanus, fulvicornis*); in borings made by the wasps in the pith of twigs or stems (*fraternus, americanus, aphidiperda, inordinatus inordinatus*); abandoned galls of other insects (*inordinatus universitatis*, possibly *aphidiperda*); and dry shelf fungi (*hubbardi*). The nests in borings of other insects or in pith usually consist of a linear series of cells separated by partitions of small pieces of pith of the wood substrate; however, there is one record (Krombein, 1961:3–4) of an aberrant nest in which two wasps were bred from a common brood cell without such a partition to separate them. In one gall nest the wasps were reported to be in oval cells, presumably not in series. No details are available of the nest architecture in the one nest found in a shelf fungus.

The prey stored consists of aphids, mostly nymphal stages, which are probably thoroughly paralyzed by malaxation of the anterior thoracic region. More prey records have been reported for *americanus* than for any of the other species; these include *Drepanaphis*, *Myzocallis* and *Therioaphis* in the Drepanosiphinae, *Rhopalosiphum* and *Aphis* or *Anuraphis* in the Aphidinae, and *Chaitophorus* in the Chaitophorinae. *S. fraternus* preys on *Therioaphis* and *Monellia*, both in the Drepanosiphinae. *S. i. inordinatus* and *aphidiperda* prey on *Aphis*

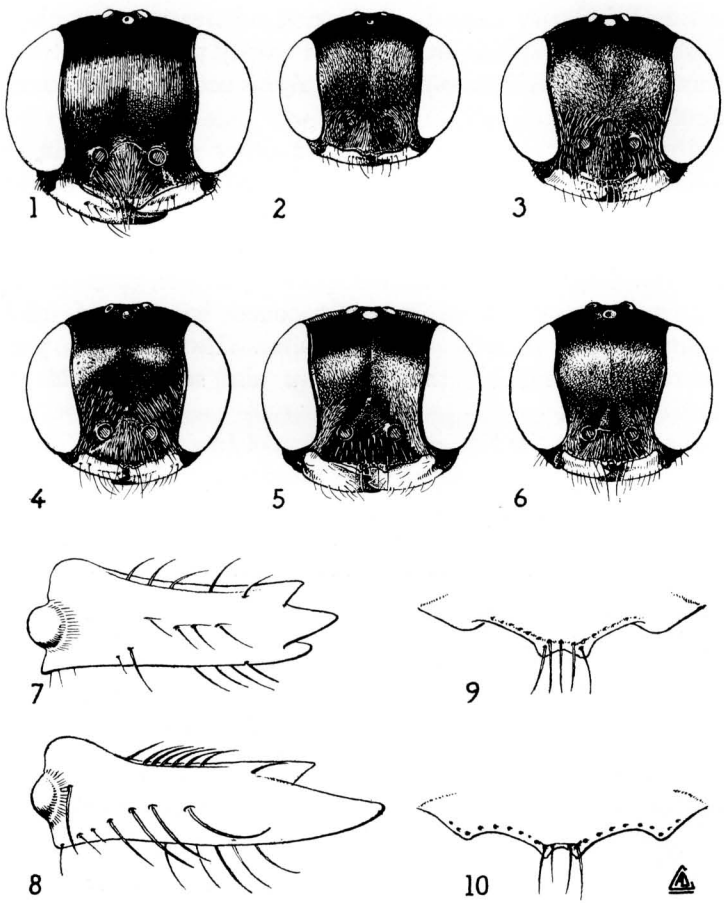
in the Aphidinae. Miss L. E. Russell advises me that all of these genera of aphids are found on woody plants except that some species of *Rhopalosiphum* and *Aphis* occur on herbaceous plants also.

Atopostigmus is quite unlike the other subgenera in its preference for a nesting site. Specimens have been reared from cells in the sand, and others were reported as occurring on sand or mud banks or in the burrow of a ground-nesting bee. I presume that the sole included species, *fulvipes*, does not dig its own burrow but utilizes abandoned burrows of other ground-nesting insects as nesting sites. There are no prey records, but probably this subgenus also selects aphids to store its nests.

Specimens in the National Collection of Insects in the Smithsonian Institution are denoted by the acronym USNM.

PROVISIONAL KEY TO AMERICAN *STIGMUS* NORTH OF MEXICO
(male of *fulvicornis* Rohwer unknown)

1. Females 2
   Males 11
2. Mandible slender, bidentate, the lower tooth longer than upper; sides of head strongly convergent immediately behind eye; scutum usually with some well-developed longitudinal rugulae; posterior surface of propodeum with reticulations of extremely large mesh; petiole rather long and slender, 0.9 times as long as hind femur, the upper surface with close longitudinal ridges (*Atopostigmus*, new subgenus) ..... *fulvipes* Fox
   Mandible somewhat stouter, tridentate, the median tooth a little longer than other two; sides of head not so strongly convergent behind eyes; scutum rarely rugulose, though occasionally closely and very finely lineolate; posterior surface of propodeum with more numerous reticulations of smaller mesh; petiole shorter and stouter, 0.85 times or less the length of hind femur, the upper surface with several ridges, but most of surface rather irregularly rugulose (*Stigmus*, sens. str.) 3
3. Clypeal surface less shiny, the punctures somewhat larger and rarely separated by more than twice the diameter of a puncture, the vestiture silvery, coarser, decumbent and sometimes dense enough to mask the basic sculpture 4
   Clypeal surface highly polished and with very sparse, minute punctures separated by at least four times the diameter of a puncture, vestiture very fine, sparse and suberect 9



FIGS. 1–10. *Stigmus* females. 1–6, frontal view of head: 1, *fulvipes* Fox; 2, *aphidiperda* Rohwer; 3, *inordinatus inordinatus* Fox; 4, *hubbardi* Rohwer; 5, *americanus* Packard; 6, *podagricus tarsalis*, new subspecies. 7–8, mandibles: 7, *americanus* Packard; 8, *fulvipes* Fox. 9–10, outline of clypeus showing apical emargination of median lobe: 9, *inordinatus inordinatus* Fox; 10, *inordinatus universitatis* Rohwer. (All drawings by A. D. Cushman.)

4. Deeply impressed pair of lines anteriorly on scutum almost punctiform, very short, about 0.2 times as long as distance between them; scutum dull from close, well-developed lineolation; ocellocular line 1.4 times as long as postocellar line ..... (*podagricus* Kohl) ..... 5.

Deeply impressed pair of lines anteriorly on scutum longer, 0.5 times or more as long as distance between them; scutum shinier, lineolation, if present, not so well developed 6

5. Small area of mesopleuron above transverse furrow with stronger rugulose reticulations of small mesh; scutum usually with several weak longitudinal rugulae along midline; mid and hind femora and tibiae largely infuscated; southern Mexico to southern Texas and Arizona ..... *podagricus podagricus* Kohl

Small area of mesopleuron above transverse furrow with very weak oblique rugulae or shagreened; scutum without trace of rugulae; legs entirely light fulvous; central Texas to Florida and Georgia ..... *podagricus tarsalis*, new subspecies

6. Antennal scape not creamy beneath; dorsal pronotal ridge strongly angulate laterally as viewed from above; head and scutum dull from close, rather strong lineolation; middle of clypeus slightly convex; Pennsylvania to North Carolina ..... *aphidiperda* Rohwer

Antennal scape creamy beneath to some extent, usually for its entire length; dorsal pronotal ridge weakly or not at all angulate laterally when viewed from above; head and thorax shinier, lineolation weaker if present; middle of clypeus flattened 7

7. Lateral lobes of clypeus very weakly developed; antenna and legs mostly fulvous; dorsal pronotal ridge with lateral angles rounded, not at all angulate; scutum shining or rather dull from lineolation, with scattered punctures, rugulae lacking; New Mexico, Arizona, California, Washington ..... *hubbardi* Rohwer

Lateral lobes of clypeus well developed; antenna and legs infuscated to a large extent ..... (*inordinatus* Fox) 8

8. Median lobe of clypeus with apical emargination well developed, tending to be semicircular; dorsal pronotal ridge not angulate laterally when viewed from above; scutum without rugulae on center of disk; occurring east of the Rocky Mountains in Upper Austral and Alleghanian zones ..... *inordinatus universitatis* Rohwer

Median lobe of clypeus with apical margin subtruncate to very shallowly emarginate; dorsal pronotal ridge angulate laterally when viewed from above; scutum occasionally with a few longitudinal rugulae on center of disk; occurring west of the Rocky Mountains in Upper Sonoran and Transition zones ..... *inordinatus inordinatus* Fox

9. Thorax noticeably depressed, the dorsum strongly flattened, the scutum except very narrow anterior declivity, scutellum, postscutellum and dorsal surface of propodeum lying in one plane; antenna and fore and mid legs light fulvous; head quadrate

and lengthened behind eyes, the sides more or less subparallel for some distance behind eyes ..... *fulvicornis* Rohwer

Thorax not depressed, the scutum in profile arched on anterior third or more 10

10. Sides of head behind eyes subparallel, only weakly convergent posteriorly; ocelloccipital distance 2.4–3.0 times the postocellar distance ..... *fraternus* Say

Sides of head convergent behind eyes at an angle of about 30°; ocelloccipital distance 2.0–2.6 times the postocellar distance ..... *americanus* Packard

11. Fore basitarsus compressed, curved near apex, longer than combined lengths of second to fourth segments; scutum usually with fine longitudinal rugulae in middle; sides and dorsum of abdominal petiole with longitudinal ridges, the petiole slender, longer than hind femur ..... (*Atopostigmus*, new subgenus) ..... *fulvipes* Fox

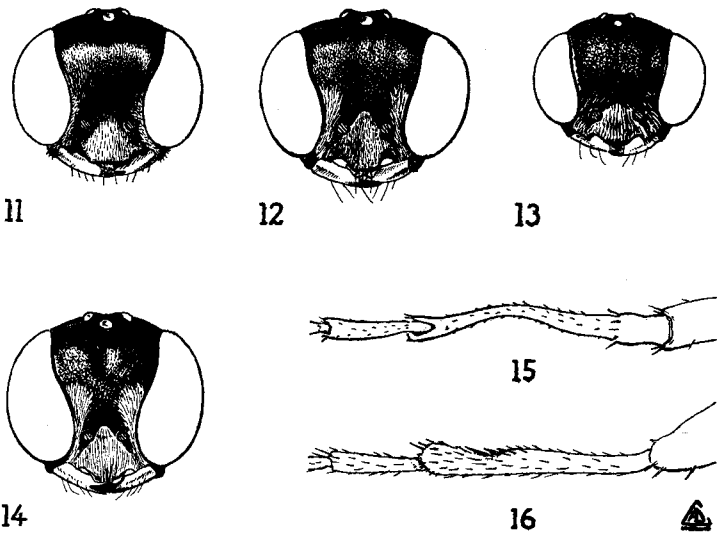
Fore basitarsus cylindrical in cross section and straight except in *hubbardi;* scutum without longitudinal rugulae; abdominal petiole shorter than or subequal to hind femur ..... (*Stigmus* sens. str.) 12

12. Mid basitarsus curved on basal half, somewhat expanded about two-thirds of distance to apex, dentate beneath near apex and excavated between tooth and apex; dorsum of abdominal petiole with longitudinal ridges only 13

Mid basitarsus straight or only very slightly and evenly arcuate over its entire length, not dentate or excavate beneath near apex; dorsum of abdominal petiole with some irregular transverse rugulae or roughening between the pair of central longitudinal ridges 15

13. Mid basitarsus shorter, as long as the following two segments united; fore basitarsus compressed, curved on basal half; eyes more strongly convergent below, interocular distance across anterior ocellus 1.6 times the interocular distance across antennal insertions; pair of deeply impressed lines anteriorly on scutum long, the distance between them 1.5 times the length of lines; upper inner eye margin with a very narrow, short lineate fovea opposite posterior ocellus; New Mexico, Arizona, California, Washington ..... *hubbardi* Rohwer

Mid basitarsus longer, equal to three following segments combined; fore basitarsus cylindrical in cross section, straight; eyes not so strongly convergent below, interocular distance across anterior ocellus 1.4–1.5 times the interocular distance across antennal insertions; pair of deeply impressed lines anteriorly on scutum almost punctiform; inner eye margin not foveate ..... (*podagricus* Kohl) 14



Figs. 11–16. *Stigmus* males. 11–14, frontal view of head: 11, *fulvipes* Fox; 12, *inordinatus inordinatus* Fox; 13, *aphidiperda* Rohwer; 14, *americanus* Packard. 15, *fulvipes* Fox, dorsal view right foretarsus, basal segments. 16, *podagricus tarsalis*, new subspecies, lateral view left mid tarsus, basal segments. (All drawings by A. D. Cushman.)

14. Small area of mesopleuron above transverse furrow finely rugulose-reticulate; mid and hind legs infuscated in part, the foreleg entirely fulvous; southern Mexico to southern Texas and Arizona ..... *podagricus podagricus* Kohl

    Small area of mesopleuron above transverse furrow not rugulose; only the hind leg occasionally infuscated in part, the fore and mid legs entirely fulvous; central Texas to Florida and Georgia ..... *podagricus tarsalis*, new subspecies

15. Ocelli small, the distance between posterior and anterior ocelli greater than diameter of a posterior ocellus; inner eye margins not strongly convergent below, the interocular distance across anterior ocellus about 1.2 times the interocular distance across antennal insertions; clypeal vestiture thinner so that punctures may be distinguished; Pennsylvania to North Carolina ..... *aphidiperda* Rohwer

    Ocelli larger, the distance between posterior and anterior ocelli less than diameter of a posterior ocellus; eyes more convergent below, interocular distance across anterior ocellus 1.4–1.5 times the interocular distance across antennal insertions; clypeal vestiture denser concealing the punctation 16

16. Median lobe of clypeus extending farther downward and somewhat lower than lateral lobes, apical margin rounded; head dull, rather densely shagreened; upper eye margin with a short linear or punctiform impression opposite lateral ocellus ..... (*inordinatus* Fox) 17

Median lobe of clypeus extending as far downward as lateral lobes and somewhat broader, apical margin truncate; head shinier, shagreening very delicate when present; upper eye margin without such a fovea ..... *fraternus* Say and *americanus* Packard

17. Dorsal pronotal ridge not angulate laterally when viewed from above; occurring east of the Rocky Mountains in Upper Austral and Alleghenian zones ..... *inordinatus universitatis* Rohwer

Dorsal pronotal ridge weakly to strongly angulate laterally when viewed from above; occurring west of the Rocky Mountains in Upper Sonoran and Transition zones ..... *inordinatus inordinatus* Fox

Stigmus subg. **Atopostigmus**, new subgenus

Female: Mandible slender, bidentate, the lower tooth longer than upper; clypeal margin bilobate in middle; posterior surface of propodeum with reticulations of large mesh; petiole rather long and slender as compared to typical *Stigmus*, the upper surface with close longitudinal ridges.

Male: Posterior surface of propodeum sculptured as in female; petiole slender, longer than hind femur, the dorsum and sides with longitudinal ridges.

Type-species: Stigmus fulvipes Fox, the only included species.

The differently shaped mandibles of the female indicate that the nesting behavior is probably dissimilar to that of members of the typical subgenus which tunnel in soft pith or use abandoned borings of other insects in wood as nesting sites. Label data on six specimens of *fulvipes* (USNM) state that they were taken on mud or sand banks, in cells in sand, and in the burrow of a ground-nesting bee, *Agapostemon radiatus* (Say). The lack of a pecten on the foretarsus suggests that *fulvipes* does not dig its own burrow in the ground, but appropriates that of another insect.

Stigmus (*Atopostigmus*) *fulvipes* Fox
Figures 1, 8, 11, 15

Stigmus fulvipes Fox, 1892:324.

I have studied the female holotype from California in the Academy of Natural Sciences, Philadelphia. The characters as described for the subgenus will separate *fulvipes* from any of its congeners. The species is widely distributed and I have seen specimens from District of Colum-

bia, Virginia, North Carolina, Georgia, Iowa, Nebraska, Texas, New Mexico, Arizona, Colorado, British Columbia, Washington, Oregon, California, Morelos, Mexico and Mexico.

Stigmus subg. *Stigmus* Panzer

Stigmus Panzer, 1804: heft 86, pl. 7. Type-species: S. *pendulus* Panzer. Monotypic.

Gonostigmus Rohwer, 1911: 559. Type-species: *G. typicus* Rohwer. Original designation and monotypic. [NEW SYNONYMY.]

Females of the typical subgenus have stout, tridentate mandibles, the clypeal margin bidentate or subtruncate in the middle, the propodeum normally with reticulations of rather small mesh, and a shorter petiole as contrasted with these conditions in the subgenus *Atopostigmus*. They are distinguished from females of the subgenus *Carinostigmus* Tsuneki by the lack of crenulate eye margins and the lack of a median carina and projection on the lower front.

Rohwer (1911) based *Gonostigmus* on a unique male which he erroneously considered to be a female, stating that it was distinct from *Stigmus* "by the head being longer than wide, the facial quandrangle being narrowed below, the larger and produced clypeus, the antenna inserted very close to the orbits." Pate (1937a:92) came "to the conclusion that *Gonostigmus* should be accorded no more than subgeneric rank inasmuch as it agrees with the typical *Stigmi* in all essential features save for the character of the temporal region of the head." I do not believe that *Gonostigmus* can be retained even as a subgenus, for the chief characters of distinction are secondary sexual characters found only in the male. These are: The head beneath is concave and clothed with dense, long, erect hair; the temples are quite broad; the head beneath is angulate posteriorly; and the mesosternum is concave and clothed with dense erect hair which is shorter than that beneath the head. Males of other typical *Stigmus* do not have such bizarre characters. Eickwort (1967:68–69) reared series of both sexes; I find that the females are typical *Stigmus* in all important aspects and have only vestiges of the peculiar vestiture noted for the male.

The name *Antronius* has occasionally been cited in the synonymy of *Stigmus*. In his list of generic names of sphecoid wasps Pate (1937b:8) credited it as Dalman MS in Zetterstedt (1840: recte p. 442, not 443). Actually, Zetterstedt cites it as *Antronius* Dalman in synonymy position under the center head *Stigmus* Panzer. Under the provisions of Article 11 (d) of the Code, *Antronius* is not available.

PENDULUS GROUP

Stigmus (*Stigmus*) *fraternus* Say

Stigmus fraternus Say, 1824:340.—Packard, 1867:387.—Fox, 1892:323.—Krombein, 1958a:24.

Stigmus conestogorum Rohwer, 1911:557 [NEW SYNONYMY].
Stigmus fraternus raui Rohwer, 1923a:100 [NEW SYNONYMY].—Rau, 1928:379–381.

Say's original description of a specimen of unknown sex from Pennsylvania is too superficial for specific recognition. I am following the traditional interpretation as established by Packard and followed by Fox. The female holotypes (USNM) of *conestogorum* from Highspire, Pa., and of *fraternus raui* from St. Louis, Mo., agree with this interpretation. The three paratype females of *conestogorum* from other localities in Pennsylvania are not conspecific with the holotype, but are specimens of *americanus* Pack.

I have seen females from New Hampshire, Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Maryland, District of Columbia, Virginia, North Carolina, South Carolina, Tennessee and Missouri. I have been unable to separate males from those of *americanus*.

Packard (1867) cited Angus as having reared *fraternus* from a stem of *Syringa* in New York. Rau (1928) in St. Louis reared two males and eight females from a nest in one twig, and three specimens from a nest in a sassafras twig. The former nest contained 19 cells in a boring 8½" long; the individual cells were a little more than 1/16" in diameter and 3/16"–¼" long; they were separated by partitions made of fine particles of pith; no cocoon was spun; the females emerged from the first eight cells stored, and the males emerged from the twelfth and seventeenth cells; the other cells contained either dead wasp larvae or from two to 23 dried aphids. Krombein (1958a) reported it as nesting in old anobiid burrows in a cowshed wall and storing nymphs of *Therioaphis* sp. and *Monellia* sp. A female from Clemson, S. C. (USNM), is labeled as coming from holes in a porch floor. Another female from Branford, Conn. (USNM), emerged from elm. A female from Rosedale, Mass. (USNM), bears a label, "ex burrows Pissodes strobi."

Stigmus (*Stigmus*) *fulvicornis* Rohwer

Stigmus fulvicornis Rohwer, 1923b:370.—Smith, 1923:553–554.

This species is known from females only. In the shape of the head it is like *fraternus* Say, but the flattened thorax separates it at once. However, I suspect that *fulvicornis* is actually a synonym of *fraternus*, and that the flattened thorax may be an artifact caused by development in too constricted a nesting site. The type-series was collected while "nesting in holes in a floor of a piazza."

I have seen the holotype and one paratype from Starkville, Miss. (USNM), and, through the courtesy of L. W. Hepner, two paratypes and five other specimens bearing the same locality data in the collection of Mississippi State University.

Smith (1923) reported the species as nesting in holes in the soft, punky pine floor of a piazza. Later in the year he obtained specimens nesting in hard pine floors in the interior of the same house. He be-

lieved that the wasps were constructing the burrows themselves, a conclusion at variance with later observations by Krombein (1955:16; 1958a:24) who found *americanus* Pack. sometimes nesting in abandoned, frass-filled burrows of anobiid beetles in structural lumber.

Stigmus (*Stigmus*) *americanus* Packard
Figures 5, 7, 14

Stigmus americanus Packard, 1867:386.—Fox, 1892:322.—Peckham and Peckham, 1898:44–45.—Hoffmann, 1938:118.—Krombein, 1955:16.—Krombein, 1956:42.—Krombein, 1958a:24.—Krombein, 1963:275.
Stigmus lucidus Rohwer, 1909:102 [NEW SYNONYMY].
Stigmus fraternus coloradensis Rohwer, 1911:559 [NEW SYNONYMY].
Stigmus (*Stigmus*) *americanus* Packard.—Krombein, 1954:6.—Krombein, 1961:64–65.

This is probably the commonest species in most of eastern North America. I have examined the female holotype of *americanus* from Illinois in the Academy of Natural Sciences, Philadelphia, the male holotype of *lucidus* from Kansas (USNM) and the female holotype of *fraternus coloradensis* from Colorado (USNM) and find that they are conspecific.

I am not at all certain that *americanus* can be maintained as distinct from *fraternus*. I am unable to distinguish the two in the male sex. In the females there is some variation in the shape and size of the head as noted in the key characters separating the two species. Apparently a similar degree of variation is manifest in the European *pendulus* Panz., although in that species the sides of the head behind the eyes are more convergent in smaller specimens as noted by Tsuneki (1954: footnote on p. 21). This is not the case in the *fraternus-americanus* complex, for I have seen typical specimens of *fraternus* which are decidedly smaller than typical specimens of *americanus*. Also, populations of both species are nesting at my home and I have found no intergrades between them. And, finally, females of the few available reared series show no intergrades.

Very rarely the thorax of the females may vary from light red to castaneous or may be blotched with red in varying degrees. The cause of this coloration is unknown. The four females I have seen come from Mississippi, two each from Utica and Starkville. Ashmead misidentified the Utica specimens as his West Indian *thoracicus*, but they differ from *americanus* only in the red or castaneous on parts or all of the thorax. Associated with the females is a series of males from Utica, bearing an Ashmead manuscript name; they have lesser and varying amounts of red or castaneous on the thorax or propodeum. I have also seen one male from Florida with some red on the prothorax and propodeum.

Stigmus americanus has a wider distribution in North America than any of the other species. In Canada it is known from Labrador, Nova Scotia, New Brunswick, Quebec, Ontario, Northwest Territories and

British Columbia. In the United States it has been collected in most states east of the 100th meridian, although I have not seen specimens from Louisiana, Texas and Oklahoma, nor from the Dakotas. In the west I have seen a single specimen from Washington.

In keeping with its status as the most common and widely distributed of North American *Stigmus*, more is known of the nesting habits and prey preferences of *americanus* than any of its congeners. Peckham and Peckham found it nesting in an old stump and provisioning with aphids, probably obtained from chokecherry. They mentioned that three females were using the same gallery, a most unusual observation and one which has not been confirmed by other observers. They reared a chrysidid, *Omalus janus* (Hald.) [recorded as *O. corruscans* (Nort.)] from one of the cells; the reared chrysidid could not be found in the USNM and its identity needs confirmation. The female *Stigmus* on which their notes were based is from Maitland, Wis. (USNM) and bears a determination label as *Stigmus americanus* by Ashmead.

Krombein published a series of notes on nesting and prey records. In 1954 he captured a female hovering before its burrow opening in the wall of a log cabin at Lost River State Park, W. Va., while carrying an aphid nymph belonging to the tribe Panaphini. In Arlington, Va. (1955, 1956), he found it nesting in deserted anobiid burrows in the wall of an old cowshed. He took it with prey as early as 2 May and as late as 20 September. All specimens of prey being transported by wasps were immature aphids belonging to *Drepanaphis acerifoliae* (Thos.), *Rhopalosiphum* sp., *Aphis* or *Anuraphis* sp., *Myzocallis* (?) sp., and undetermined species belonging to the Aphini or Panaphini. In 1955 he reported a female transporting an aphid nymph, possibly a species of *Chaitophorus*, at Dunn Loring, Va., on the trunk of a dead tree with punky wood. Later (1958a) he recorded it as preying on nymphs of *Drepanaphis* and Panaphini and one *Drepanaphis* adult in Arlington, and on *Drepanaphis* nymphs at Plummers Island, Md. At Plummers Island, Md. (1961), he found a nest in an old boring 1.5 mm–1.8 mm wide in a dead *Chionanthus* twig. Thirty nymphal and adult aphids of a species of *Therioaphis* were packed into a brood chamber 10 mm long with two wasp eggs. The nest was quite unusual in that this chamber was not divided into two cells by the usual partition of pith particles. Two *americanus* females were reared from the eggs. Finally, Krombein (1963) noted that the species was actively nesting in deserted anobiid borings in the cabin rafters and porch floor at Plummers Island from 8 May to 26 October.

There are in the USNM some specimens of *americanus* bearing label data on nesting sites. A female from Lyme, Conn., was nesting in chestnut supports in the basement of a barn; one from Philadelphia, Pa., was taken from burrows in porch furniture; several from the District of Columbia were in "wooden mortar"; one from Winchester, Va., came from pine lumber; and one from Tryon, N. C., was in the siding of a

house. One series from Barcroft, Va., was reared from borings in pith of *Rhus glabra.* A series from Liberty Corner, N. J., bears a label "reared from L. aculeatus." C. H. Hoffmann, reared this series and published notes (1938) on the parasites of a scolytid beetle, *Lesperisinus aculeatus* (Say) reared from old galleries of the beetle in a felled ash tree. He stated that the *Stigmus* was not likely to be associated as a parasite of the beetle. In view of other rearing records it is certain that the wasp was merely using abandoned borings of the beetle as a convenient nesting site. A specimen from Chambersburg, Pa., J. R. Stear, collector, was "reared from L. molesta"; there is no bush or tree in northeastern U.S. having this specific name in a genus beginning with L, so it is probable that this label may similarly refer to a nesting site in the abandoned boring of some beetle.

Inordinatus Group

Stigmus (*Stigmus*) *inordinatus* Fox

This taxon is readily separable into two subspecies, typical *inordinatus* occurring west of the Rocky Mountains and *inordinatus universitatis* east of the Rockies. The nominate subspecies has the pronotal ridge angulate laterally when viewed from above and the apical margin of the median lobe of the clypeus of the female weakly emarginate or subtruncate; in *universitatis* the pronotal ridge is not angulate and the median lobe of the clypeus of the female is almost semicircularly emarginate. I have seen three intergrade females from Colorado, having the pronotal keel as in *universitatis* and the clypeal lobe as in typical *inordinatus.*

It is possible that the two subspecies are also separable on ethological grounds. The only nesting records for typical *inordinatus* are from series of linear cells in the pith of twigs or stems and the only records for *universitatis* are in galls.

Stigmus (*Stigmus*) *inordinatus inordinatus* Fox

Figures 3, 9, 12

Stigmus inordinatus Fox, 1892: 322.
Stigmus fulvipes var. *coquilletti* Rohwer, 1911: 559 [NEW SYNONYMY].
Stigmus reticulatus Mickel, 1918 (1917):330.—Krombein, 1958b:190.

I have examined the holotypes of all of the taxa listed above. Fox described *inordinatus* from both sexes from Colorado; the holotype is a female in the Academy of Natural Sciences, Philadelphia. Rohwer had both sexes of *coquilletti* from Los Angeles Co., Calif. (USNM); a female is the holotype. Mickel described *reticulatus* from a unique female from Marin Co., Calif., in the University of Nebraska collection; I synonymized it with typical *inordinatus* (1958b).

I have seen typical *inordinatus* from Colorado, New Mexico, Arizona, Utah, Nevada, California, Oregon, Washington, British Columbia and Montana.

Rohwer (1909:102) stated that Mrs. Cockerell saw a female catching aphids at Beulah, New Mexico. Wasbauer and Simonds (1964) reported this taxon as constructing linear series of cells in twigs of mulberry and peony. The cells were 2.4–9.0 mm long, and were separated by partitions of bits of pith 5.0–8.5 mm thick. The wasps stored the cells with wingless *Aphis*, possibly *frangulae* Kalt. The cells in one nest contained 12–16 aphids per cell, and in another 20–30 aphids per cell. Parker and Bohart (1966:95) reported rearing typical *inordinatus* from elderberry stems in both Nevada and California; they also recorded the chrysidid wasps *Omalus variatus* (Aar.). *O. glomeratus* (Buyss.) and *O. cressoni* (Aar.) as parasites. A female from Utah (USNM) was reared from a raspberry cane and three females from Washington (USNM) are labeled "in peach."

Stigmus (*Stigmus*) *inordinatus universitatis* Rohwer
Figure 10

Stigmus inordinatus universitatis Rohwer, 1909:102.

Rohwer's type-series was from Colorado and Kansas. He did not mention the sex in his description. There are in the USNM the holotype female and a paratype female, both from Colorado. Fortunately, Rohwer's holotype belongs definitely to the eastern subspecies and is not an intergrade. There is occasionally variation in the density of the clypeal punctation in the female, one from Washington, D.C., having the punctures quite separated.

I have seen specimens from Colorado, Illinois, West Virginia, Virginia, District of Columbia, Maryland, New Jersey and Connecticut.

This subspecies has been reared only from galls of other insects. Rohwer misidentified as *conestogorum* Roh. a specimen of *universitatis* which Richardson (1915) reported to be storing green aphids in numerous oval chambers in a dried gall on white oak; he called the gall-maker *Holcaspis globulus*, a cynipid we now recognize as *Disholcaspis quercus-globulus* (Fitch). Richardson's wasp from New Brunswick, N.J., is in the USNM. Another female from the District of Columbia (USNM) is pinned with part of a gall; the label states "Stigmus from galls of C. q. globulus, 5 July 1883," presumably a gall of the same species as the preceding. Still a third female from Urbana, Illinois (USNM), was reared from an oak club gall. The absence of rearing records from other kinds of nesting sites suggests that abandoned galls may be the preferred nesting sites of *inordinatus universitatis*, in contrast to the nests of typical *inordinatus* which consist of a linear series of cells in pith of twigs.

Stigmus (*Stigmus*) *hubbardi* Rohwer, new status
Figure 4

Stigmus inordinatus hubbardi Rohwer, 1911:559.

Females of this are rather readily separable from *inordinatus* Fox, the closest relative, by the weakly developed lateral lobes of the clypeus and

the predominantly fulvous antennae and legs. Females from Palm Springs, Calif., the type-locality, and Asotin, Washington, agree in having the scutum shining and with scarcely noticeable lineolation. Females from Arizona and New Mexico agree with all males in having the scutum rather dull because of well-developed lineolation. A similar situation occurs in females of *fulvipes* Fox from the same areas. Perhaps two subspecies should be recognized on the basis of this difference in scutal sculpture, but it seems advisable to defer a final decision until more extensive material is at hand.

The species has been collected in Colorado, Utah, New Mexico, Arizona, California and Washington.

The type-series (USNM) was "bred from pupae in *Polyporus*," a shelf fungus.

Stigmus (*Stigmus*) *podagricus* Kohl

This species may be readily recognized by the combination of the following characters: Both sexes with a pair of extremely short, punctiform impressions anteriorly on the scutum; the male with the middle basitarsus in profile somewhat arcuate, narrowed on basal two-thirds and rather abruptly expanded on apical third; and the female with the median lobe of the clypeus narrowly, semicircularly emarginate apically.

S. podagricus has not been recorded previously from America north of Mexico. The material at hand ranges from the states of Veracruz and Morelos, Mexico, north into Arizona and Texas, thence eastward into Florida and Georgia.

Stigmus (*Stigmus*) *podagricus podagricus* Kohl, new status

Stigmus podagricus Kohl, 1890:65.

My interpretation of the typical subspecies is based on study of the holotype male from Orizaba, Veracruz, Mexico, in the Natural History Museum, Vienna, a short series of both sexes from Cuernavaca, Morelos, Mexico, and females from Madera Canyon, Ariz., and Hidalgo Co., Tex.

Both sexes differ from those of *p. tarsalis*, new subspecies, by the rugose reticulate sculpture of the upper triangular area of the mesopleuron, and in the female by the infuscated areas on the legs and the presence of a few weak, central, longitudinal rugulae on the scutum. A female from San Antonio is transitional to *p. tarsalis* in that the scutum lacks rugulae, but the upper mesopleuron is as in typical *podagricus*; only the hind femur is infuscated rather than the mid and hind femora and tibiae.

Stigmus (Stigmus) podagricus tarsalis, new subspecies
Figures 6, 16

This subspecies is known from Georgia, and in the Gulf States from Florida to central and northern Texas. The upper area of the meso-

pleuron in both sexes is either shagreened or has only very weak, oblique rugulae, and the females have the legs entirely light fulvous and the scutum without median longitudinal rugulae.

Holotype: ♂, Coleta, Alabama, H. H. Smith (USNM Type No. 72510).

Male: Length 5.2 mm. Black: Mandible except teeth, scape narrowly beneath and pronotal lobe, creamy; rest of antenna except apical half of flagellum, tegula, axillary sclerites and legs except hind femur and tibia, light fulvous; hind femur and tibia, and last abdominal segment, castaneous.

Allotype: Same data as type.

Female: Length 5.2 mm. Coloration as in holotype except all legs light fulvous.

Paratypes: TEXAS: 2♂, 1♀, Devils River, 5 May 1907, F. C. Bishopp (USNM); 1♂, Hunt, Guadalupe River, 12 June 1953, W. W. Wirth (USNM). ALABAMA: 2♂, same data as holotype (USNM); 1♀, Langdale, Chambers Co., H. H. Smith (USNM). FLORIDA: 1♀, Monticello, 15 March 1919, W. A. Hoffmann (USNM); 1♂, Palatka, 3–4 May 1916, J. C. Bradley (Cornell); 2♂, Alachua Co., 10 March 1955, H. V. Weems, Jr. (Fla. State Coll. Arthropods); 1♂, Levy Co., 6 May 1955, F. W. Mead (Fla. State Coll. Arthropods); 1♂, 1♀, Gainesville, 22 April 1952, G. S. Walley (Ottawa); 1♀, Oneco, 25 March 1955, J. C. Martin (Ottawa); 1♂, Fort Ogden, 10 April 1952, O. Peck (Ottawa). GEORGIA: 1♂, DeWitt, Mitchell Co., 8 June 1914, C. S. Spooner (Cornell).

Male paratypes are 4.3–5.2 mm long, and females 5.2–5.3 mm. About half of the males have entirely fulvous legs.

Stigmus (*Stigmus*) *aphidiperda* Rohwer

Figures 2, 13

Stigmus aphidiperda Rohwer, 1911:558.

The type-series of both sexes came from Highspire, Pa. (USNM). The specimen bearing Rohwer's determination as the type female is actually a male. In his original description Rohwer mentioned having two females from Colorado, but these were actually specimens of typical *inordinatus* Fox not *aphidiperda*; they were not part of the type-series.

The type-series from peach bore a label, Quaintance No. 5692. The notes under this number state—"Pith had been tunneled by this small wasp. Cells completely filled with wingless specimens of *Aphis persicaeniger* Sm." A series of both sexes from District of Columbia (USNM) bears labels "bred with *Agrilus ruficollis*," a buprestid beetle which makes galls in raspberry and blackberry; it is not clear from this label whether the *aphidiperda* had nested in the gall or in the pith of the cane.

Specimens are known from Pennsylvania, District of Columbia, Virginia and North Carolina.

Stigmus (*Stigmus*) *temporalis* Kohl

Stigmus temporalis Kohl, 1892:204, pl. 13, figs. 31, 32.
Gonostigmus typicus Rohwer, 1911:560 [NEW SYNONYMY].
Stigmus (*Gonostigmus*) *temporalis* Kohl.—Eickwort, 1967:68–69, fig. 26.

S. *temporalis*, a member of the Inordinatus Group, is not known to occur north of the states of Morelos and Veracruz, Mexico. It is treated here because of the new synonymy involved at both the subgeneric and specific levels. The known distribution (south to Panama) suggests that it occurs primarily in tropical areas of Central America.

Kohl described *temporalis* from a male from Guatemala; it is in the Natural History Museum, Vienna. Rohwer's holotype from Motzorongo, Veracruz (USNM), is a male and not a female as supposed by Rohwer. I have studied both holotypes and can find no basis for maintaining *typicus* as a discrete taxon. After examination of Rohwer's holotype, Pate (1937a:92) suggested that *typicus* might prove to be a synonym of *temporalis* Kohl. He failed to recognize that Rohwer's holotype was a male which agrees in all essential details with Kohl's description and figures of *temporalis*.

In addition to the two holotypes I have seen specimens from Morelos, Mexico; Honduras; Guatemala; Costa Rica and Panama. A positive association of sexes was made on the basis of Eickwort's (1967) rearing from twig nests in Costa Rica. As mentioned under the subgeneric heading, the male of *temporalis* is quite aberrant in secondary sexual characteristics, such as the broadened temple, and the concave underside of the head and mesosternum, each of which is clothed with dense, erect hair. The female of *temporalis* agrees with females of typical *Stigmus* in the conformation and sculpture of the head and mesopleuron. It has vestiges of the pubescence which is so striking in the male, but the vestiture is much shorter and more limited in extent. There is a small posterolateral patch beneath on head, and the mesopleuron anteriorly and mesosternum have similar vestiture. In females of other typical *Stigmus* this vestiture is very much sparser. Females of *temporalis* are superficially very similar to those of *podagricus* Kohl in the shape and vestiture of the clypeus and the sculpture of the pronotum and scutum, but they differ in the vestiture of the head beneath and the mesopleuron, in the broader temples, and in the weaker epicnemial suture.

In Costa Rica Eickwort (1967) found *temporalis* in competition with the colletid bee *Chilicola ashmeadi* (Cwfd.) for nesting sites in dead hollow *Erythrina* twigs. The wasp constructed a linear series of 4–9 cells separated by partitions 1.5–10.0 mm thick of wood particles chewed from the sides of the twig. Wingless aphids were stored as prey.

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