

On the Subfamily Astatinae. Part VI. The American Species in the Genus *Dryudella* Spinola (Hymenoptera: Sphecidae)¹

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ABSTRACT

Ten American species of *Dryudella* are recognized and keyed; all are also described and discussed, and their relationships are evaluated. The biology of the genus is summarized and new information on nesting habits and new prey records are presented for *D. rhimpa*, n. sp.,

D. picta (Kohl); *D. montana* (Cresson); and *D. pernix*, n. sp. New synonymy includes *D. florissantensis* (Rohwer) placed under *D. montana* (Cresson), and *D. aspera* (Fox), *D. kohlii* (Cameron), and *D. asperiformis* (Rohwer) placed under *D. picta* (Kohl).

The active and brightly marked wasps in the genus *Dryudella* are the most specialized of Astatini, but little is known about them. The genus is essentially Holarctic; however, 1 species is Ethiopian, and the range of several Nearctic species extends into the northern limits of the Neotropical Region. As far as is known there are no species in the Oriental Region. In North America, the species are entirely western in their distribution, and 1 is adventive to the Hawaiian Islands.

Spinola (1843) described *Dryudella* but stated that it was either a new genus or subgenus of *Astata*. Later authors have considered it a subgenus, but Parker (1962) treated it as a genus. Cresson (1881) described 5 American species, and Patton (1895) incorrectly lumped 3 of them. The names proposed by Cameron (1890), Fox (1893), and Rohwer (1909a, b) are synonyms. Kohl (1888) named a Mexican species, Cockerell (1914) described a unique female from Colorado, and Williams (1946) described an adventive Hawaiian species and pointed out Patton's error in lumping Cresson's species.

Dryudella Spinola

Dryudella Spinola, 1843: 135. Type-species: (*Dryudella ghiliani* Spinola) = *Dryudella tricolor* var. *ghiliani* Spinola. Designated by Pate (1937).

General Appearance.—Small, 4.5–10 mm, compact wasps. Head and thorax black (1 species red); abdomen either black or red or a combination of the two or body metallic blue; wings generally light brown, banded in some species; punctation of body coarse, dull, especially on propodeum.

Head.—Compound eyes holoptic in males, dichoptic in females; flagellomere I longest, others decreasing in length toward apex; males with tyloides on some flagellomeres; median clypeal lobe of male often pointed, females often trilobed; 2nd labial palpomere variable; malar space longer than 1.0 midocellus diameter, frons of male often with pigmented swellings; setae on labrum simple; pubescence of head generally moderate, more dense on postocular areas, clypeal bristles dark.

Thorax.—Punctation of pleuron, propodeum generally coarse, dull, that on dorsum, sternum finer; scrobal sulcus present; episternal sulcus complete to forecoxal cavity; 2 midtibial spurs in both sexes;

midcoxae, femora not modified; pubescence moderate, usually longer on anterior margin of scutum, laterally on propodeum.

Wings.—Marginal cell truncate, appendiculate, of variable length, shorter than pterostigma; 3 submarginal cells; veinlet that forms apical side of 1st submarginal cell angulate, appendiculate; 2nd submarginal cell shorter than first, recurrent veins ending at first and second or more often both at second; hindwing with spur of anal vein present; jugal lobe of hindwing enlarged in males, in females of variable size, incised in some.

Abdomen.—Punctation less dense, somewhat shiny; male sternites without hairbrush, apical margin not modified; sternite VIII either pointed or truncate apically; pygidium of female without spines along lateral margin.

Systematics.—The distinction between *Astata* and *Dryudella* is clearly seen when males of the 2 genera are compared. The broad malar space, short marginal cell, and dull, coarse punctation of *Dryudella* males separate them from *Astata* males. The strong pygidial armature of *Astata* females differentiates them from females of *Dryudella*.

Since male *Diploplectron* are dichoptic, they are easily distinguished from the holoptic males of *Dryudella*. However, the females of these genera are quite alike and not easily separated. Generally, female *Dryudella* have both recurrent veins ending in the 2nd submarginal cell, and the 1st flagellomere is longer than the second; *Diploplectron* females usually have a recurrent vein ending in both of the 1st 2 submarginal cells, and flagellomeres I and II are of equal length. The configuration of the head is a more reliable character; in *Diploplectron* it is quadrate, about as long as wide when viewed from above; in *Dryudella*, it is almost twice as wide as long.

The dull, granular integument of *Dryudella* is distinctive and none of the other Astatini genera exhibits the extensive white pigmentation found in *Dryudella*.

Relationship between the Nearctic Species.—About half the Nearctic species of *Dryudella* belong to the Holarctic *stigma* (Panzer) group. The species in this group are *montana* (Cresson), *pinguis* (Dahlbom), *picta* (Kohl), *elegans* (Cresson), and *pernix*, n. sp. Males have pointed, protruding median clypeal lobes and prominent frontal tubercles; females lack an anal incision in the hindwing, and the clypeal lobe is 3-toothed.

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The *millsi* group contains 2 species, *millsi* Cockerell and *rhimpa*, n. sp. The first is known from a unique female. This group is closely allied to the *stigma* group, but the females have either a rounded or truncate clypeal lobe.

The *caerulea* (Cresson) group contains a single species and appears to be the least specialized. The metallic blue color and broad anal lobe of the females are diagnostic. This group shares some characters with the genus *Uniplectron*; when the wings of the 2 genera are compared, it is difficult to distinguish one from the other.

The European *tricolor* (Vander Linden) group is represented in the Nearctic Region by a single species, *D. bella* (Cresson). The reduced venation, the small isolated frontal tubercles of the males, and the deeply incised jugal lobe and short 1st flagellomere of the females are characteristic.

The *immigrans* group contains a single species and appears to be only remotely related to other *Dryudella*. The configuration of the genitalia and the small isolated frontal tubercles of *immigrans* (Williams) are unlike other *Dryudella* males. Females *immigrans*, in general appearance, look like *Diploplectron*; both are small and have forked clypeal lobes.

BIOLOGY

Life history studies are lacking for most *Dryudella*. However, our knowledge of some species have been enhanced by the works of several authors: Ferton (1901, 1908) recorded the prey of the European *D. tricolor* and *D. stigma*. Williams (1946) presented unequalled observations after rearing successive generations of *D. immigrans* in glass jars. Verhoeff (1951) cited prey records for 3 European species, *stigma*, *pinguis* and *freygessneri* (Carl). Evans (1963) described a nest and prey of *D. montana*.

Evans (1957) included *Dryudella* as a subgenus of *Astata*, summarized the known information on the biology of *Astata*, and pointed out that behavior in the genus is highly specialized. He also suggested that *Dryudella* and *Diploplectron* have some structural features and choice of prey in common. More correctly, some *Dryudella* species show tendencies toward *Diploplectron*, and some lean toward *Astata*.

Males of *Dryudella*, like those of *Astata*, are often observed perched on some vantage point such as a clod, rock, or twig. Darting flights are made from this perch at a speed swifter than the eye can follow. Several species of *Dryudella* and *Astata* are often perched in close proximity, each darting off and then reappearing in a short time on the same perch.

I have often puzzled over this odd behavior, and the only plausible explanation I can suggest is that it has something to do with their mating habits. However, perching never takes place near nesting sites, and pebbles tossed over a perched male do not elicit a response. Therefore, if this behavior is a prelude to mating, then the males are probably looking for high-flying females and would not respond to moving objects close by.

Males of *Diploplectron*, another genus in the tribe *Astatini*, do not perch. However, they lack both the enlarged eyes and the broad jugal lobe of the hindwing. They are not swift fliers, and they frequent niches close to the ground such as grass clumps and low-growing weeds. I have observed mating pairs in these situations.

It seems reasonable to conclude that the development of the holoptic condition and the enlarged jugal lobe of the hindwing has something to do with the perching activities of male *Dryudella* and *Astata*. Drone honey bees, *Apis mellifera* L., have similar holoptic eyes, and their nuptial flights occur high in the sky; a similar behavior may have evolved in *Dryudella* and *Astata*.

D. immigrans.—Williams (1946) was able to rear successive generations of *D. immigrans* in large glass jars. The following information is condensed from his observations.

Nest Construction.—The burrow is excavated with the mandibles and the forelegs. The nest is a short tunnel that has more than 1 cell and is left open until storage is completed.

Prey.—Williams observed the wasps capturing nymphs of *Nysius nigriscutellatus* Usinger on *Portulaca* plants and he used nymphs of this species as prey in the glass jars. The prey species is now treated as a synonym of *N. caenosulus* Stål.

Williams described the stinging of the prey as follows: "she appears little excited when a suitable *Nysius* nymph is found, but grasps it and brings her abdomen beneath and forward to sting the bug to immobility. One of the wasps observed malaxating her prey held it beneath her, venter up, by means of her first and second pair of legs and applied her mouthparts to its throat and leg bases."

Provisioning.—When she returns to the nest with prey, the female enters head first, holding the prey beneath her body. The egg is laid obliquely between the forecoxae of 1 of the bugs. Williams did not say how the bugs were positioned in the cells.

Immature Stages.—The egg is glossy white and about 1.05 mm long. A full-grown larva shows no pilosity except sparsely about the mouth region of its globular head. The body is little modified; there are no thoracic papillae, and the lateral body ridges are inconspicuous. The pupa is active, and the cocoon is a fragile affair of silk and soil grains.

D. montana.—Evans (1963) observed a nesting female and recorded the following information.

Nest Construction.—The burrow was made in a small sand flat and entered the soil at an angle of about 50° from the horizontal; there was 1 sharp curve before the burrow terminated in a slight enlargement at a depth of 4 cm. The nest was evidently newly constructed since only a storage cell was found at the end of the burrow.

Prey.—Small nymphs were found in the storage cell. One was a reduviid of the genus *Zelus* or *Pselliopus*, two were scutellerids of the genus *Eurygaster*, and four were the cydnid *Corimelaena montana* Van Duzee.

Provisioning.—The prey was carried to the nest venter up beneath the wasp. The nest entrance was closed when the wasp was away and reopened when she returned. The prey was deposited on the ground while the wasp opened the burrow. How the prey was carried into the nest was not stated.

Pinned with a female *montana* in the collection of the California Insect Survey is a nymph of *Alydus* sp. (Alydidae). The wasp and prey were collected by P. D. Hurd at Echo Lake, Calif., VII-21-48.

D. pinguis.—Verhoeff (1951) listed the following prey records: *Trapezonotus arenarius* (L.), *Drymus sylvaticus* (F.), and nymphs of ? *Nysius thymi* (Wolff). All are members of the family Lygaeidae.

D. rhimpa.—I found 3 ♀ of this species nesting on the north slope of the old Putah Creek channel on the University of California, Davis campus on Oct. 17, 1961. The site was a 15×6-ft, bare, sandy area.

Site selection.—The wasp flew rapidly around the nest area and finally settled on the ground; she then made short, slow, hovering flights. The final site was apparently selected as she walked about, alternately flipping her wings forward and extending the antennae while they vibrated above the surface of the soil.

Nest Construction.—The burrow was constructed in compact soil at the base of a slight outcrop. The wasp started by biting chunks of soil and gravel from the surface. The loose soil was then removed with the forelegs by pushing it back between the widely separated mid- and hindlegs. The larger bits of gravel and clods were dragged from the hole with the mandibles and pulled down the slope. While the wasp was digging the burrow, it never flicked its wings.

The nests entered the ground at about 30° to the horizontal and were 11-14 mm long. None of the nests had cells, but in two, prey was found at the end of the burrow. Apparently *Dryudella* females, like those of *Astata*, dig an initial burrow before they capture the prey and then construct the cells when there is enough prey stored in the burrow to provision 1 or more cells.

After the initial construction was completed, the wasp emerged from the burrow and then returned to and left it several times. With each emergence, the distance from the nest increased until she began to fly around the nest in twisting circles and loops that progressively included the entire area. The flights increased in speed until the wasp was darting rapidly over the area. She then left.

Provisioning.—The female returned to the nest with prey held venter up beneath her and landed immediately in front of the nest entrance, dropped the bug, and entered. The wasp turned around within the burrow and pulled the bug down the hole. After emerging from the hole, the wasp made the usual circuitous flight around the nest and surrounding area before departing. She returned in about 30 min with another bug.

Prey.—One nest contained 4 nymphs and 1 adult of the pentatomid *Thyanta punctiventris* Van Duzee; the other contained a nymphal *Lygaeus* sp.

"Sleeping Males."—I caught several *rhimpa* males

while they were digging on a sandy creek bank at dusk in Southern California. Probably they were digging shallow burrows in which the spend the night, although I did not observe them at length.

A female *rhimpa*, collected by F. X. Williams bears the following label "Dannville, Calif., July 2, 1952, carrying prey on wing." The prey was identified as a nymph of the boxelder bug, *Leptocoris trivittatus* (Say) (Rhopalidae).

D. picta.—At Davis, Calif., I captured several females of this species on a low-growing weed near the campus; nymphs of *Lygus* sp. were common on the weed. Both the wasps and prey were placed in large glass jars with soil and plants. I was able to observe partial nest construction and prey capture, but apparently the conditions were not suitable for the wasps to complete their nesting cycle.

The burrow was dug in the same way as that of *rhimpa*. The prey was captured in the following manner. The female crawled along a stem tapping it with her antennae. When she encountered her prey she grasped it on the dorsal part of the abdomen with her mandibles. Then she arched her abdomen under her and stung the bug on the sternum between its legs. She then reversed the bug and turned it venter up. Holding the bug by the base of the antennae with her mandibles, she flew off.

I also observed several female *picta* each of which captured a bug in the usual manner and then, after turning it venter up, malaxated the neck several times. The mouthparts were then applied to the exuding fluids. After the bug was malaxated several times, it was discarded.

D. pernix.—Pinned beneath a female *pernix* is an adult *Liorhyssus hyalinus* (F.) (Rhopalidae). The wasp and prey were collected by M. A. Cazier 2 miles NE Portal, Ariz., X-12-60.

SYSTEMATICS

Key to the American Species of *Dryudella* Spinola

Males

1. Frons, in profile, with angular swellings (Fig. 10). 2
Frons, in profile, rounded (Fig. 67)..... 8
2. Apical flagellomeres with white ventral markings (Fig. 22, 23)..... 3
Apical flagellomeres black..... 4
3. Flagellomere VII with tyloides, those on IV-VI linelike (Fig. 22); clypeal lobe blunt (Fig. 25); pygidium apically truncate..... *pernix*, n. sp.
Flagellomere VII without tyloides, those on IV-VI flat, wide, polished (Fig. 23); clypeal lobe projecting (Fig. 24); pygidium apically rounded..... *elegans* (Cresson)
4. Frons with 2 small isolated tubercles; mandibles mostly white; flagellomere IV without tyloides (Fig. 14)..... *immigrans* (Williams)
Frons with tubercles joined medially; mandibles black or with only small median spot..... 5
5. Flagellomere V apically swollen, flat basally (Fig. 19, 20)..... *montana* (Cresson)
Flagellomere V symmetrical (Fig. 15-18)..... 6
6. Forewing dark brown apically; clypeal lobe narrow apically (Fig. 26)..... *picta* (Kohl)

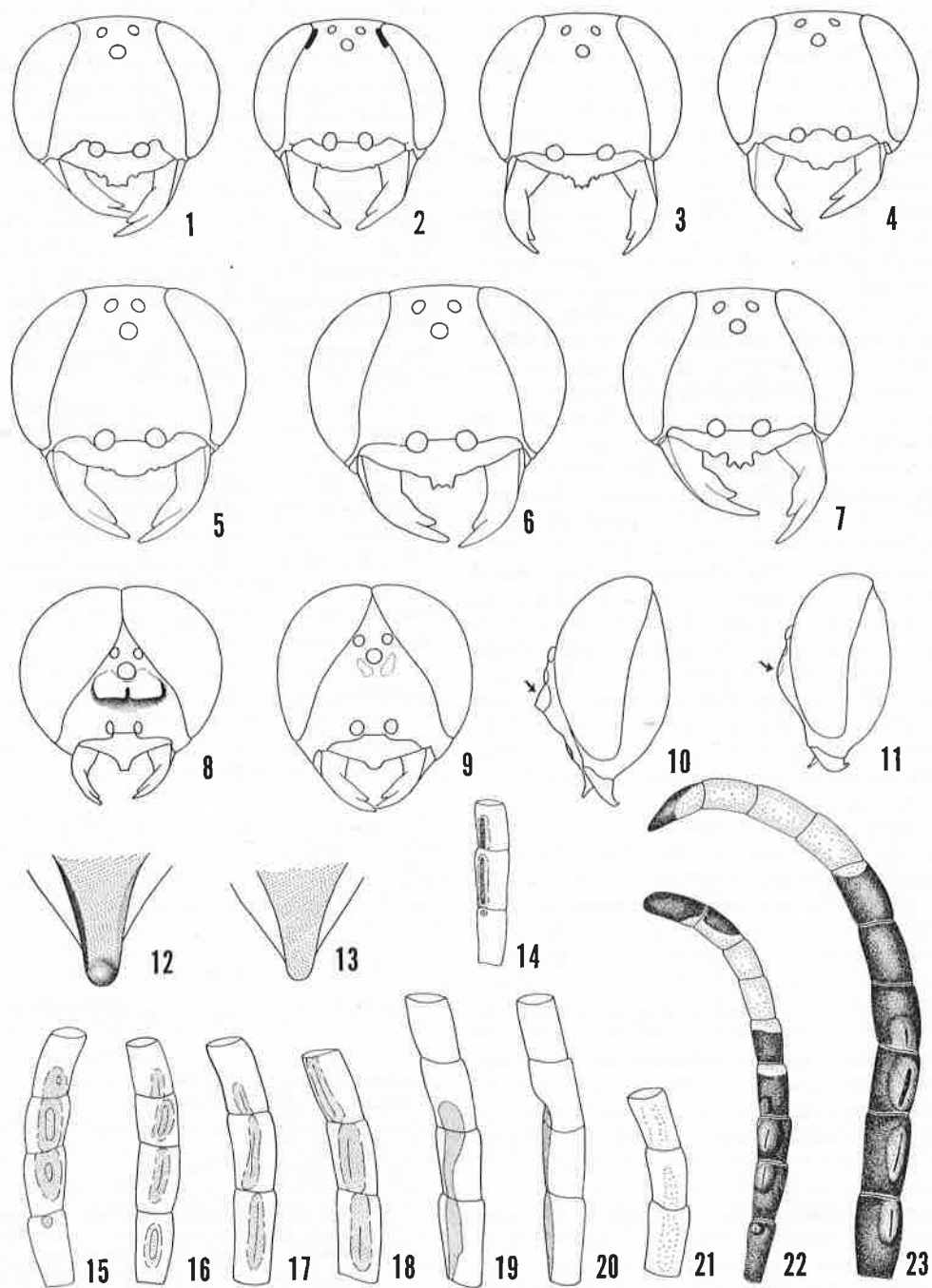


FIG. 1-7.—Front view of heads of *Dryudella* females. 1, *pinguis*; 2, *bella*; 3, *montana*; 4, *immigrans*; 5, *rhimpa*; 6, *elegans*; 7, *picta*.
 FIG. 8, 9.—Front view of heads of *Dryudella* males. 8, *rhimpa*; 9, *bella*.
 FIG. 10, 11.—Side view of heads of *Dryudella* males. 10, *montana*; 11, *pinguis*.
 FIG. 12, 13.—Dorsal view of pygidia of *Dryudella* females. 12, *elegans*; 13, *pernix*.
 FIG. 14-23.—Flagellomeres of *Dryudella* males. 14, IV-VI, *immigrans*; 15, III-VI, *pinguis*; 16, III-VI, *bella*; 17, IV-VI, *rhimpa*; 18, IV-VI, *caerulea*; 19, 20, ventral and side views, IV-VII, *montana*; 21, IV-VI, *picta*; 22, III-XI, *pernix*; 23, II-XI, *elegans*.

- Forewing hyaline or evenly stained; clypeal lobe truncate, broad apically (Fig. 8, 27)..... 7
7. Spot on mesopleuron, tegulae white; clypeal lobe as in Fig. 8; tubercles on frons prominent, raised, (Fig. 10)..... *rhimpa* n. sp.
- Mesopleuron, tegulae black; clypeal lobe as in Fig. 27; tubercles on frons weak, hardly raised (Fig. 11)..... *pinguis* (Dahlbom)
8. Body metallic blue..... *caerulea* (Cresson)
- Body black and red..... *bella* (Cresson)

Females

1. Clypeal lobe with 3 teeth (Fig. 1, 3, 6, 7)..... 2
- Clypeal lobe broadly rounded, truncate, or bilobed (Fig. 2, 4, 5)..... 7
2. Body metallic blue..... *caerulea*
- Body all red or black and red..... 3
3. Pygidium weak, not extending more than 1/4 length of tergite; forewing darkly stained apically; clypeal teeth diverging..... *picta*
- Pygidium long, extending at least 1/2-2/3 length of tergite; forewing hyaline or evenly stained..... 4
4. Base of forewing white..... 5
- Base of forewing black or dark brown..... 6
5. Pronotal tubercle white; pygidium as in Fig. 12, 1st recurrent vein ending in 2nd submarginal cell..... *elegans*
- Pronotal tubercle black; pygidium as in Fig. 13; 1st recurrent vein interstitial with r-m..... *pernix*

6. Abdomen bicolored, red and black; interocellar area with 10-15 pits; clypeal lobe as in Fig. 1... *pinguis*
- Abdomen red; interocellar area with 5-7 pits; clypeal lobe as in Fig. 3..... *montana*
7. Body light red; forewing with light brown band in area of marginal cell; clypeal lobe hardly protruding (Fig. 2)..... *bella*
- Body black and red; forewing not banded; clypeal lobe protruding (Fig. 4, 5)..... 8
8. Clypeal lobe with 2 teeth (Fig. 4); base of forewing white..... *immigrans*
- Clypeal lobe without teeth (Fig. 5); base of forewing black..... 9
9. Abdomen black and red; interocellar area with about 15 pits; pygidium not extending more than 1/4 length of tergite..... *millsi* Cockerell
- Abdomen red; interocellar area with less than 10 pits; pygidium strongly developed, extending at least 2/3 length of tergite..... *rhimpa*

Dryudella caerulea (Cresson)

(Fig. 18, 28, 31, 38, 51, 58, 59)

Astata caerulea Cresson, 1881: iv. (Holotype ♂, "Nev." Acad. Nat. Sci., Philadelphia.)

MALE.—Metallic blue; forewing dark brown, violaceous; hindwing lightly stained brown. Pubescence short, erect, black. Punctuation not uniform; face,

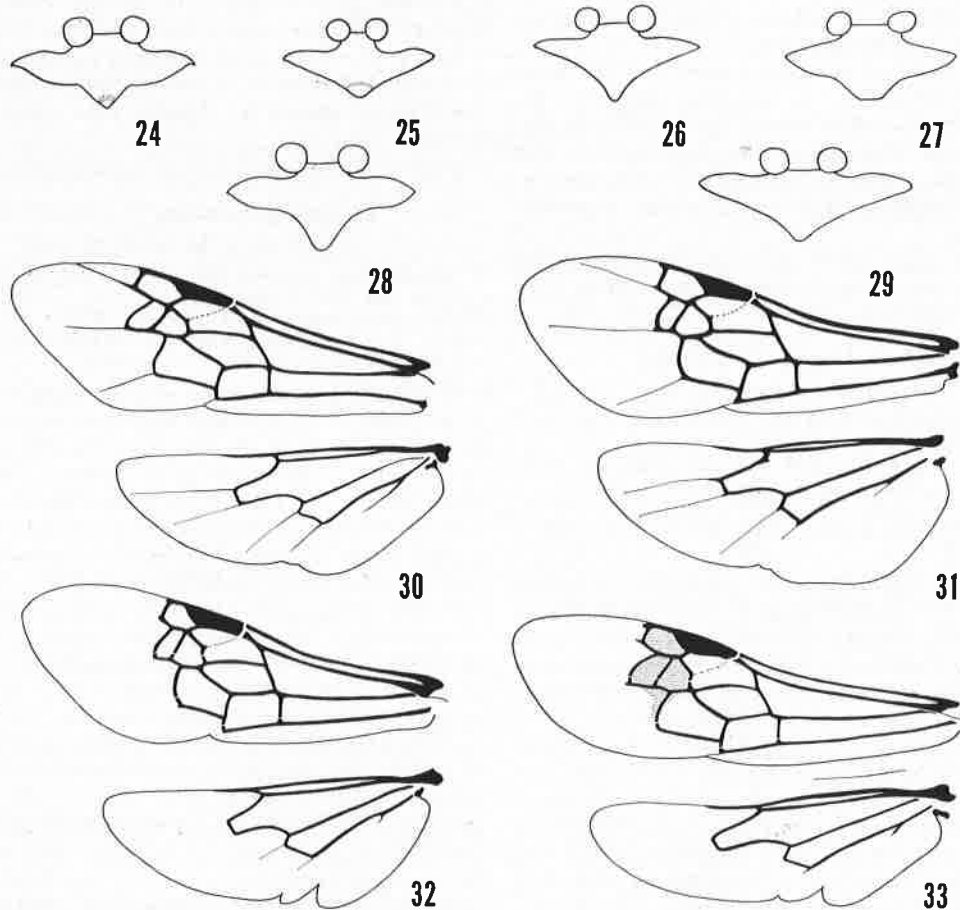


FIG. 24-29.—Front view of clypeus of *Dryudella* males. 24, *elegans*; 25, *pernix*; 26, *picta*; 27, *pinguis*; 28, *caerulea*; 29, *immigrans*.
 FIG. 30-33.—Fore- and hindwings of *Dryudella* females. 30, *rhimpa*; 31, *caerulea*; 32, *immigrans*; 33, *bella*.

pronotum, anteriorly on scutum, pleuron, propodeum densely micropunctate, appearing granular with larger inclusions; summit of scutum, scutellum, legs, abdomen shagreen, somewhat shiny with scattered macropunctures; propodeal enclosure with low, but distinct striae radiating away from median, metanotum laterally with low reticules. Median clypeal lobe obtuse, tooth no larger than diameter of median ocellus; frons smoothly rounded in profile; flagellomeres IV-VI with vestigial flat tyloides running length of article; tangential line between compound eyes as long as length of flagellomere VI; 2nd submarginal cell receiving 1st recurrent vein near middle of cell; sternite VII, VIII (Fig. 38, 58); pygidium truncate apically with large macropunctures; aedeagus (Fig. 51); length 7-10 mm.

FEMALE.—About as in male except: median clypeal lobe 3-toothed; short, peglike tubercles on clypeal margin laterad from median lobe; interocellar area densely micropunctate with 30-40 macropunctures; jugal lobe of hindwing broad; vein rs with basal spur (Fig. 31); pygidium shagreen, but shiny, with scattered macropunctures, apically round; lateral carina extending not more than $\frac{1}{3}$ length of tergite.

Variation.—Some specimens have a median longitudinal suture on the scutellum. The sculpture varies from pebblelike to reticulostriate.

Systematics.—This distinctive species is the only metallic-blue *Dryudella*. It does not appear to be closely allied to the other species and is probably the least specialized. The lack of white pigmentation, the unmodified frons, and the remnant of a vein coming off rs in the hindwing indicate this species' generalization.

Range.—Western North America, extending south from Idaho to the Mexican State of Puebla (Fig. 59).

Material Examined.—82 ♂, 47 ♀, May-October.

Dryudella pinguis (Dahlbom)

(Fig. 1, 11, 16, 27, 42, 45, 56, 66)

Larra pinguis Dahlbom, 1832: 50. (Lectotype ♀, "Oland," Lund, Sweden.)

Larra pinguis Zetterstedt, 1838: 436, nec. Dahlbom, 1832. (Lectotype ♀, "Calix," Lund, Sweden.)

Astata jaculator Smith, 1845: 1157. (Holotype ♀, "Captured at Weybridge, Aug. 22nd 1845," British Mus. (Nat. Hist).)

MALE.—Black; foretarsi in front, base of abdomen red, bilobed frontal spot, base of foretibia yellowish white, forewing lightly stained. Pubescence white. Punctuation not uniform; frons, notum, pleuron, propodeum, densely micropunctate, pebblelike, somewhat dull; sternum finely sculptured, shiny; abdomen finely punctured, shiny; propodeal enclosure with irregular pattern of low, small reticules. Median clypeal lobe produced, apically truncate and as wide as diameter of lateral ocellus; flagellomeres stout, III-V with line-like tyloides extending length of article, on VI extending $\frac{1}{2}$ length; tangential line between compound eyes as long as length of flagellomere III; sternite VII, VIII (Fig. 42, 45); pygidium broadly rounded apically, almost truncate; aedeagus (Fig. 56); length 7-8 mm.

FEMALE.—About as in male except: body mostly black in some specimens, no white markings; median clypeal lobe 3-toothed, with small lateral projection on clypeal margin; interocellar area densely micropunctate, with 10-15 macropunctures; pygidium finely sculptured, shiny with few scattered pits, lateral carina extending $\frac{1}{2}$ length of tergite.

Variation.—The Palearctic specimens that I have examined have light markings on the mid- and hind-tibiae. Females from higher altitudes are almost all brownish black.

Systematics.—Townes (1951) recorded this species from Alaska, but he used the name *stigma* (Panzer). Verhoeff (1951) pointed out that *pinguis* was not a synonym of *stigma*, and he listed characters by which the two could be separated.

This species is one of the few sphecids, other than adventive, whose range is Holarctic. Apparently, it occurs at rather high elevations. The specimens I have seen from Colorado were taken at 9250 and 11,300 ft.

The tyloides on flagellomere III and the broadly truncate clypeal lobe will separate males of *pinguis* from other Nearctic *Dryudella*. Female *pinguis* have a 3-toothed clypeal lobe (Fig. 1), the configuration of which is different from other *Dryudella* females.

Distribution.—Its range is more extensive than that of any other *Dryudella*. From Europe, it ranges eastward across Russia, to Alaska, then southward to Colorado. (Fig. 66).

Material Examined.—6 ♂, 5 ♀, June-July.

Dryudella montana (Cresson)

(Fig. 3, 10, 19, 20, 34, 47, 53, 64)

Astata montana Cresson, 1881: v. (Holotype ♀, "Nev." Acad. Nat. Sci., Philadelphia.)

Diploplectron florissantensis Rohwer, 1909a: 122. (Holotype ♀, "Florissant, Colorado, VI-28-1908 (S. A. Rohwer)," USNM. NEW SYNONYMY.)

MALE.—Black; abdomen except sternite I red; wings light brown; frontal tubercles, pronotal lobe, spot on mesopleuron, tegula, humeral plate, base of costal vein of forewing ivory white. Pubescence white except for black clypeal bristles and brown setae on sternum. Punctuation not uniform; pronotum, scutum anteriorly, pleuron, propodeum densely micropunctate, dull with scattered inclusions; propodeal enclosure reticulostriate medially in some specimens; abdomen finely sculptured, shiny; pygidium minutely shagreen, with scattered macropunctures. Median clypeal lobe produced, narrowed almost to a point apically but yet truncate; flagellomeres IV-VI with flat broad tyloides, those on IV and V running length of article, only basally on VI, flagellomere VI enlarged, slightly turned apically (Fig. 19, 20); frontal tubercles broad, shelflike, joined medially and extending to near compound eye margin; tangential line between compound eyes as long as length of flagellomeres VI-VIII; 1st recurrent vein ending in 2nd submarginal cell; sternite VII, VIII (Fig. 34, 47); pygidium apically broad, truncate; aedeagus (Fig. 53); length 5.5-9.5 mm.

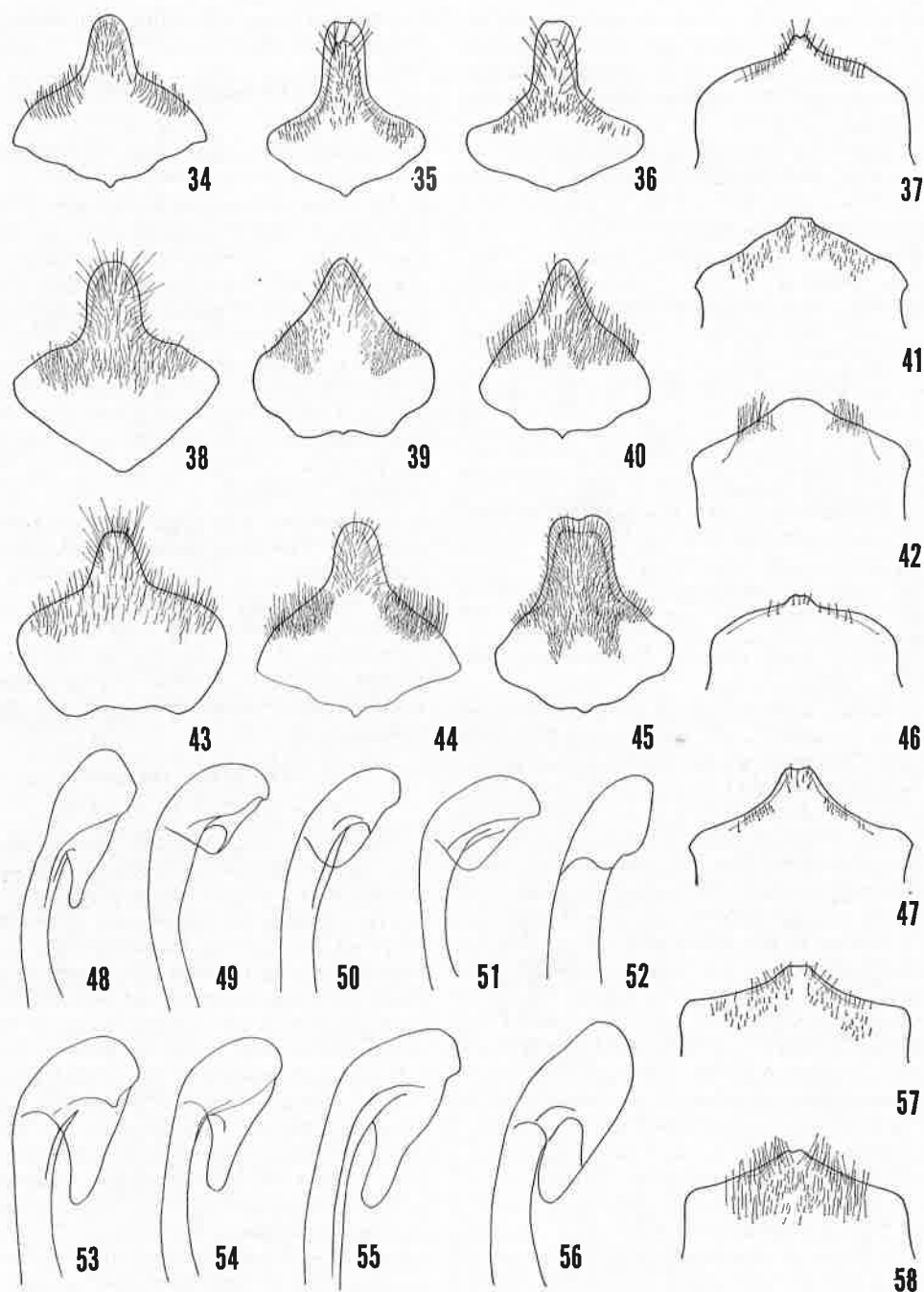


FIG. 34-36.—Eighth sternite of *Dryudella* males. 34, *montana*; 35, *picta*; 36, *bella*.
 FIG. 37.—Seventh sternite of *D. bella* male.
 FIG. 38-40.—Eighth sternite of *Dryudella* males. 38, *caerulea*; 39, *elegans*; 40, *pernix*.
 FIG. 41, 42.—Seventh sternite of *Dryudella* males. 41, *picta*; 42, *pinguis*.
 FIG. 43-45.—Eighth sternite of *Dryudella* males. 43, *immigrans*; 44, *rhimpa*; 45, *pinguis*.
 FIG. 46, 47.—Seventh sternite of *Dryudella* males. 46, *immigrans*; 47, *montana*.
 FIG. 48-56.—Lateral view of *Dryudella* aedeagus. 48, *elegans*; 49, *picta*; 50, *bella*; 51, *caerulea*; 52, *immigrans*; 53, *montana*; 54, *pernix*; 55, *rhimpa*; 56, *pinguis*.
 FIG. 57, 58.—Seventh sternite of *Dryudella* males. 57, *elegans*; 58, *caerulea*.

FEMALE.—About as in male except: body entirely black except abdomen; pubescence dark brown to black; median clypeal lobe small, minutely 3-toothed, laterally with small projection on clypeal margin; interocellar area shagreen, with 5–7 macropunctures; pygidium broadly rounded apically, lateral carina extending $\frac{3}{4}$ length of tergite.

Systematics.—This montane species is similar to both *picta* and *elegans*, but the crooked 5th flagellomere of the males and the narrowly trilobed clypeal lobe of the females are distinctive.

Range.—Mountains of western United States (Fig. 64). Cresson (1881) appropriately named this species as it is found only in mountainous regions.

Material Examined.—65 ♂, 46 ♀, June–September.

Dryudella picta (Kohl)

(Fig. 7, 21, 26, 35, 41, 49, 61)

Astutus pictus Kohl, 1888: 146. (Holotype ♂, "Mazatl., Mexico, 1883." Vienna, Austria. Kohl states the locality as "Mexico (Bilimek leg).")

Astata kohli Cameron, 1890: 68. (Holotype ♀, "Ventana, Durango, Mex." British Mus. (Nat. Hist.) NEW SYNONYMY.

Astutus asper Fox, 1893: 546–7. (Holotype ♀, "Montana," Acad. Nat. Sci., Philadelphia.) NEW SYNONYMY.

Astata aspera Dalla Torre 1897: 651. (emendation).

Astata asperiformis Rohwer, 1909b: 371. (Holotype ♂, "Boulder, Colo.," Acad. Nat. Sci. Philadelphia.) NEW SYNONYMY.

MALE.—Black; abdomen except sternite I, base of tergite II red; wings light brown, apically dark brown; frontal tubercles, pronotal lobe, spot on mesopleuron, tegula, humeral plate, spot in front of foretibial base ivory white. Pubescence moderate, light brown or white. Punctuation not uniform; head, thorax closely shagreen with dense macropunctures, dull; sternum less coarse, shiny; propodeal enclosure with thin, close, low striae radiating away from metanotum, median; abdomen finely sculptured, shiny. Median clypeal lobe produced, narrow, pointed apically (some specimens truncate); flagellomeres IV–VI with line-like tyloides running length of article, tyloides on VII basal, weltlike (tyloides vary in size and length in the hypodygm); frontal tubercles low, broadly joined medially; tangential line between compound eyes as long as flagellomere VI; 2nd submarginal cell receiving both recurrent veins; sternite VII, VIII (Fig. 35, 41); pygidium truncate, glabrous with scattered pits apically, short not more than $\frac{1}{4}$ length of tergite; aedeagus (Fig. 49); length 6–8 mm.

FEMALE.—About as in male except: no white markings, median clypeal lobe with 3 large teeth, laterad from lobe clypeal margin with prominent, blunt projection; interocellar area shagreen with 12–18 pits; pygidium weak, apically glabrous, lateral carina extending $\frac{1}{2}$ length of tergite.

Variation.—The pitting is coarser in some, and the scutellum is medially impressed in most specimens.

Systematics.—This coarsely punctured species is easily separated from other Nearctic *Dryudella* by the dark apical band on the forewing. The configuration of the clypeal lobe is diagnostic in both sexes.

Range.—Upper and lower Sonoran regions of western North America extending south from Idaho to the Mexican State of Morelos. (Fig. 61).

Material Examined.—124 ♂, 67 ♀, April–October.

Dryudella millsii Cockerell

(Fig. 66)

Dryudella millsii Cockerell, 1914: 32. (Holotype ♀, "Canadian zone of Long's Peak," USNM)

HOLOTYPE: FEMALE.—Black; abdomen red medially; wings lightly stained. Pubescence brown to black, scanty. Punctuation not uniform; body finely shagreen, shiny except for dull, granular mesopleuron, propodeal enclosure; weak striae radiating from metathorax on propodeal enclosure. Median clypeal lobe produced, truncate with large basal punctures; interocellar area with 15 pits; 2nd submarginal cell receiving both recurrent veins; pygidium short, lateral carina not extending more than $\frac{1}{4}$ length of tergite; length 7 mm.

MALE.—Unknown.

Systematics.—This species is known from the holotype only. The short pygidium, truncate clypeal lobe, and moderately pitted interocellar area separate it from other Nearctic *Dryudella* females.

Range.—Known only from Long's Peak, Colo. (Fig. 66). It may be that *millsii* has distribution similar to *pinguis*, and this high-altitude distribution could be the reason more material has not been collected.

Dryudella rhimpa, n. sp.

(Fig. 5, 8, 17, 30, 44, 55, 62)

HOLOTYPE: MALE.—Black, frontal shelf, pronotal lobe, spot on mesopleuron, tegula, humeral plate ivory white; wings hyaline, faintly stained brown posteriorly; abdomen red except base of sternite I. Pubescence white, erect, of variable length but not longer than length of flagellomere I. Face, pronotum, anteriorly on scutum, pleuron, propodeum densely micropunctate, appearing granular; dorsal propodeal enclosure with short, low, twisting carinae medially; punctuation of other body parts moderate, but surface shiny. Median clypeal lobe pointed, apical portion truncate, lobe as long as distance between lateral ocelli; frontal shelf extending nearly to compound eyes (separated from eye by about diameter of lateral ocellus); tangential distance between compound eyes as long as length of flagellomeres V + VI; flagellomeres IV–VI with linelike tyloides, that on VI extending only midlength of article; 2nd submarginal cell receiving both recurrent veins; sternite VIII (Fig. 44); pygidium broadly rounded apically; aedeagus (Fig. 55); length 8 mm.

FEMALE.—About as in male except as follows: no white markings; pubescence on clypeus, sternum, legs, sternites black; median clypeal lobe broadly rounded, small blunt tooth bordering median lobe; interocellar area with 6–10 pits; pygidium glabrous, tapered, rounded apically, lateral carina extending almost to base of tergite; length 6.5–9 mm.

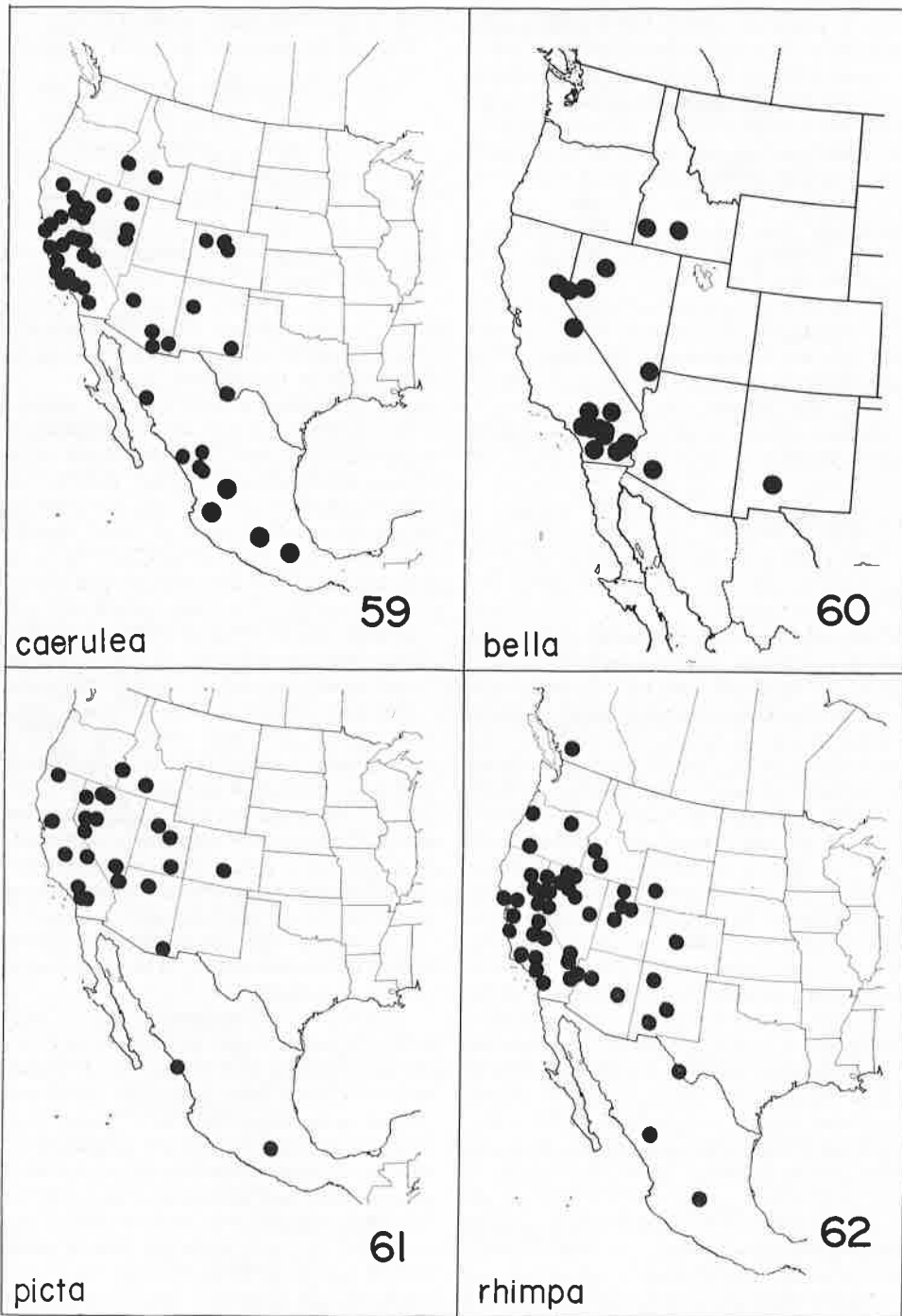


FIG. 59-62.—Maps of known distribution of species of *Dryudella*. 59, *caerulea*; 60, *bella*; 61, *picta*; 62, *rhimpa*.

Variation.—Some males have the tip of the abdomen black. The striae on the propodeal enclosure are barely visible on some specimens, and on others they are numerous and distinct. The length of the median clypeal lobe of the male varies.

Systematics.—I originally concluded that this species was *millsi*, but after examining the type of the latter, I have found them distinct but closely allied. They differ in the formation of the median clypeal lobe: in *millsi* the lobe is truncate (like an *Astata* female), but in *rhimpa* the lobe is broadly rounded. Also in *rhimpa* the interocellar area is less punctured than in *millsi*.

Types.—Holotype and 3 paratypes, Davis, Calif., V-12-65 (F. D. Parker); 14 paratypes, Davis, Calif. IV-14-62, V-2-62, V-10-60, VIII-21-55, VIII-28-55, IX-28-58, X-12-61, X-17-62, X-2-60 (R. M. Bohart, A. S. Menke, F. D. Parker, M. E. Irwin, J. C. Downey, D. Q. Cavagnaro). Metatypes, 204, collected from April to October. Holotype in collection of University of California, Davis.

Range.—Western North America extending south from British Columbia to the Mexican State of Queretaro. (Fig. 62).

Dryudella elegans (Cresson)

(Fig. 6, 12, 23, 24, 39, 48, 57, 63)

Astata elegans Cresson, 1881: vi. (Holotype ♀, "W. T." Acad. Nat. Sci., Philadelphia.)

MALE.—Black; abdomen except sternite I red; spot on mandible, flagellomere VIII apically, ventrally, IX, X, most of XI ventrally, frontal tubercles, pronotal lobe, spot on mesopleuron, tegula, humeral plate, base of fore- and hindwing, basally on fore- and mid-tibia in front, wide band on summit of tergite I ivory white; tarsi reddish brown; wings lightly stained. Pubescence short, white. Punctuation not uniform; scutum except anteriorly, scutellum polished with scattered pits; propodeal enclosure dull, granular, rest of body shiny, finely shagreen, pleura with fine microstriae, propodeum laterally with oblique striae. Median clypeal lobe projecting, pointed apically; tubercles on frons, flat, broad, joined basally; flagellomere III with small buttonlike apical tyloides, tyloides on IV and V wide, polished; on VI wide, polished, extending $\frac{1}{2}$ length of article; tangential line between compound eyes about as long as combined length of flagellomeres V + VI; 2nd submarginal cell receiving both recurrent veins; sternites VII, VIII (Fig. 39, 57); pygidium basally with deep, coarse pits, apically glabrous, round, aedeagus (Fig. 48); length 7-9.5 mm.

FEMALE.—About as in male except: head without white markings; pubescence black on clypeus, sternum, sternites; median clypeal lobe 3-toothed; clypeal margin with lateral blunt projection; interocellar area with 6-10 pits; pygidium long, glabrous, noblike apically, lateral carina raised, extending $\frac{3}{4}$ length of tergite.

Variation.—Some males lack the white tergal markings.

Systematics.—This brightly daubed species is like

pernix but differences in the configuration of the male antenna and female pygidium will separate the two. These 2 species are the only Nearctic *Dryudella* with white pigments on the male antenna.

Range.—Western North America extending south from Idaho to Arizona. (Fig. 63).

Material Examined.—31 ♂, 24 ♀, May-September.

Dryudella pernix, n. sp.

(Fig. 13, 22, 25, 40, 54, 66)

HOLOTYPE: MALE.—Black; abdomen except sternite I red; tarsi reddish brown; spot on mandible, apically, ventrally on flagellomere VII, ventrally on most of VII-X, XI basally, frontal tubercles, pronotal lobe, spot on mesopleuron, tegula, humeral plate, base of fore- and hindwing, spot basally on foretibia ivory white; wings slightly stained. Pubescence sparse, white. Punctuation not uniform; most of body finely shagreen, shiny; summit of scutum, scutellum polished, with scattered pits; dorsal propodeal enclosure finely pitted, pebblelike, laterally coarser; sternum, abdomen finely microsculptured, shiny. Median clypeal lobe produced, thick, apically blunt, round (Fig. 25); tyloides on flagellomere III apical, weltlike, on IV larger, medial, weltlike; on V and VI linelike extending length of article; on VII basal, weltlike; frontal tubercles shelflike joined medially below median ocellus; tangential line between compound eyes as long as flagellomere X; 2nd submarginal cell receiving both recurrent veins; sternite VIII (Fig. 40); pygidium broad, truncate apically, lateral carina extending $\frac{3}{4}$ length of tergite; aedeagus (Fig. 54); length 6.5 mm.

FEMALE.—About as in male except: white markings only on base of wings, faint spot on mesopleuron in some; pubescence brown on clypeus, sternum, legs, abdomen; median clypeal lobe short, wide, 3-toothed; laterad from median lobe small tubercles on clypeal margin; interocellar area finely shagreen, shiny with 6-10 pits; 1st recurrent vein interstitial with r-m; pygidium tapered, round apically, surface finely shagreen, lateral carina extending $\frac{3}{4}$ length of tergite.

Variation.—The 1st recurrent vein is interstitial with r-m in some males. The scutellum is sometimes impressed medially.

Systematics.—This species could easily be confused with *elegans* as it and *pernix* are closely allied. They can be separated in the males by the flattened tyloides, pointed clypeal lobe, and long pygidium of *elegans*; *pernix* males have weltlike tyloides, a smaller blunt clypeal lobe, and a truncate pygidium. The females are more distinct: *elegans* females have the pronotal lobe, tegulae, and mesopleural spot white, the 2nd submarginal cell receives both recurrent veins, and the pygidium is broad, glabrous with a prominent raised lateral carina. Females of *pernix* lack the white markings, the 1st recurrent vein is interstitial with r-m, and the pygidium is flat, narrow, and shagreen.

Types.—Holotype, Glamis, Calif., IV-8-64 (P. M. Marsh) *Euphorbia* mats; 5 paratypes same data, (R. M. Bohart, F. D. Parker). Metatypes, 10, from the following North American States: CALIFORNIA: Borrego Vly., IV-6-64 (P. M. Marsh). ARIZONA: 2 miles

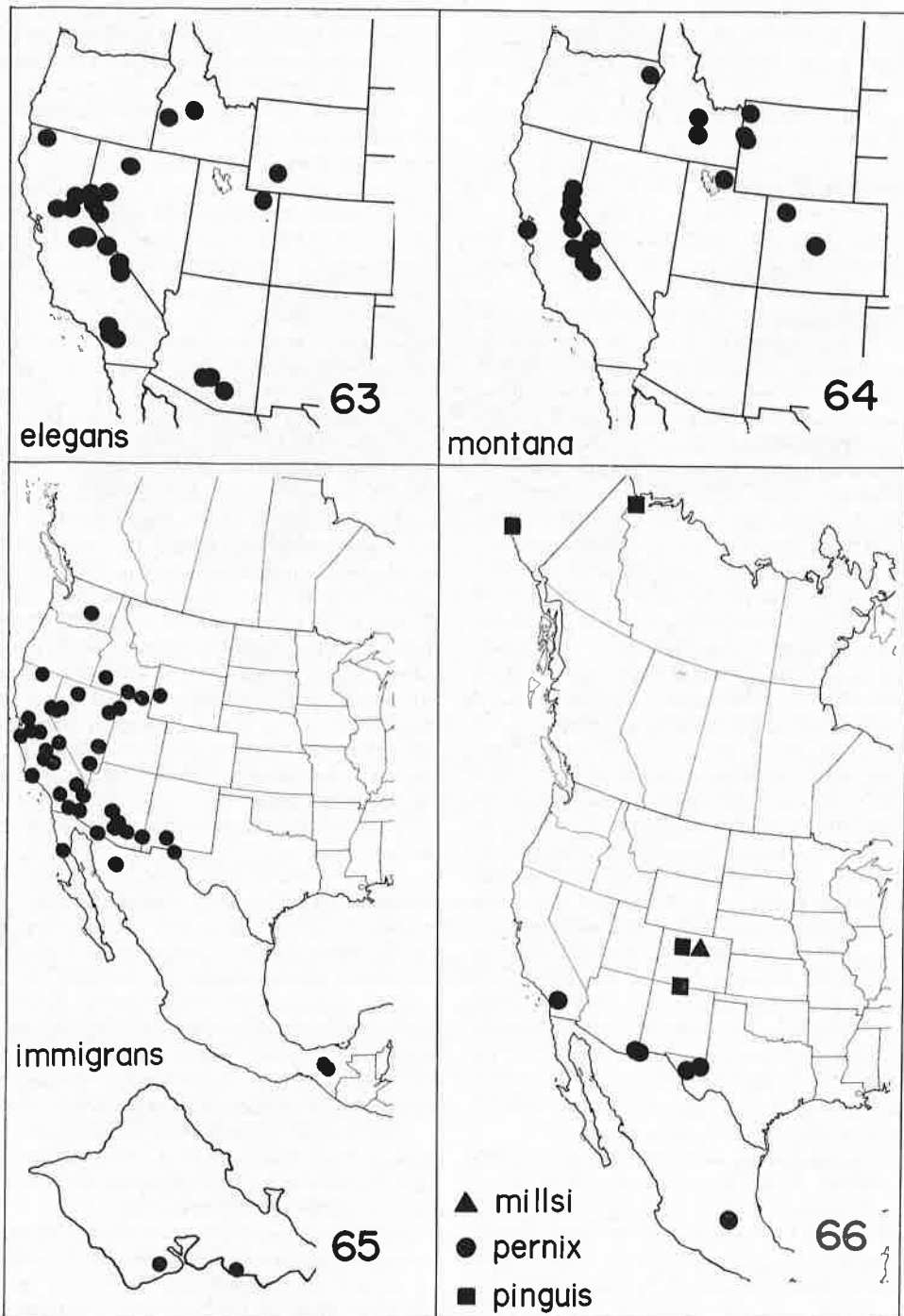


FIG. 63-66.—Maps of known distribution of species of *Dryudella*. 63, *elegans*; 64, *montana*; 65, *immigrans*; 66, *millsii*, *pernix*, and *pinguis*.

NE Portal, IX-30-60 (M. Cazier), VIII-1962 (H. A. Scullen). NEW MEXICO: ROSEO, VIII-22-58 (R. M. Bohart). TEXAS: 16 miles E. VanHorn, IX-24-65 (R. W. Thorp); 16 miles S Pecos, IV-16-61 (Rozen and Schrammel); Pecos, V-15-27 (J. O. Martin); Hidalgo: Pachuca, VII-28-54 (Univ. of Kansas Exped.). Holotype in the collection at the University of California, Davis.

Range.—Lower deserts of southwestern North America. (Fig. 66).

Dryudella immigrans (Williams)

(Fig. 4, 14, 29, 32, 43, 46, 52, 65)

Astata immigrans Williams, 1946: 641. (Holotype ♀. "Oahu, Honolulu, at Exp. Sta., H.S.P.A.," Bishop Museum.)

MALE.—Black; abdomen red; foretibia, tarsi reddish brown; most of mandible, tubercles on frons, pronotal lobe, basally on fore- and midtibia, tegula, humeral plate, base of fore- and hindwing veins, juncture of prestigma and pterostigma ivory white; wings hyaline, slightly stained apically. Pubescence white. Punctuation not uniform; pronotum, scutum, pleuron, propodeum densely micropunctate, pebblelike; sternum, abdomen less punctured, shiny. Median clypeal lobe pointed, but truncate apically, flagellomeres V and VI with weltlike basal tyloides; frontal tubercles small, separated medially; interocellar area more swollen than in other species; tangential line between compound eyes as long as flagellomere I; 1st recurrent vein ending in 2nd submarginal cell, sternite VII, VIII (Fig. 43, 46); pygidium short, tapered, rounded apically; aedeagus (Fig. 52); length 4.5-6 mm.

FEMALE.—About as in male except; frons, legs, tegula without white markings; median clypeal lobe divided medially with 2 teeth; laterad from lobe slight, flat tubercle on clypeal margin; interocellar area shagreen, with 2-5 macropunctures; lateral carina of pygidium so short that it appears vestigial; pygidium tapered, truncate apically.

Systematics.—This species is the smallest representative of the Nearctic *Dryudella*, and at a casual glance specimens of it might be mistaken for *Diploplectron*. The species is easily separated from other *Dryudella* by its size. The white mandibles and isolated white frontal tubercle of the male and the notched clypeal lobe of the female are characteristic. Unlike other *Dryudella* that have the frons modified, *immigrans* males have isolated tubercles.

Range.—This species is one of the most widely ranging *Dryudella*. It has been recorded from nearly all the Western States and as far south as Chiapas, Mexico; Williams (1946) described it from Hawaii. (Fig. 65).

Material Examined.—71 ♂, 19 ♀, March-October.

Dryudella bella (Cresson)

(Fig. 2, 9, 15, 33, 36, 37, 50, 60, 67)

Astata bella Cresson, 1881: vi. (Holotype ♂, "Cala." Acad. Nat. Sci., Philadelphia.)

MALE.—Black; mandibles partly, inner side of fore- and midtibia, tarsi, hindtibia, tarsi reddish brown, ab-

domen red; 2 small isolated spots on frons, tegula, humeral plate, base of veins in fore- and hindwing, partially on prestigma, pterostigma, base of foretibia ivory white; wings hyaline except for light brown cloud in area of marginal cell; isolated brown spot laterally on tergite II (faint or absent in some specimens). Pubescence silvery white. Punctuation not uniform; frons medially, dorsally on pronotum, anteriorly on scutum, metanotum shagreen, somewhat dull; remainder of body finely micropunctate, shiny; pleuron, propodeum laterally with oblique striae (faint in some specimens, strong in others), dorsal propodeal enclosure finely reticulostriate, striae radiating like a fan across surface from upper lateral corners, horizontal basally, longitudinal apically (striae faint or absent in some specimens). Clypeus with short round median lobe (Fig. 9); flagellomeres IV-VI with faint tyloides running length of article; frons without shelf, rounded in profile; tangential line between compound eyes as long as length of flagellomere II; 1st recurrent vein ending at base of 2nd submarginal cell or interstitial with r-m; sternite VII, VIII (Fig. 36, 37); pygidium with large macropunctures, almost truncate apically; aedeagus (Fig. 50); length 5-7 mm.

FEMALE.—About as in male except for the following: body bright red except tip of mandible, around ocelli, strip along inner margin of compound eye at vertex, base of coxa in some specimens, spot laterally on tergite II in some, setae on apical clypeal margin, spines on legs, abdomen apically black in some specimens; body glabrous, shiny with few scattered punctures; propodeum laterally with oblique striae; median clypeal lobe short, broad, truncate, short peglike projection laterad from median lobe, (Fig. 2); 1st recurrent vein ending in apical part of 1st submarginal cell or interstitial with r-m; pygidium tapered, round apically, lateral carina extending more than ½ length of tergite.

Variation.—The male median clypeal lobe is more bowed in some specimens than in others. The sculpturing of the propodeal enclosure varies from a pebblelike surface to distinct raised striae. Some females have more black markings than others.

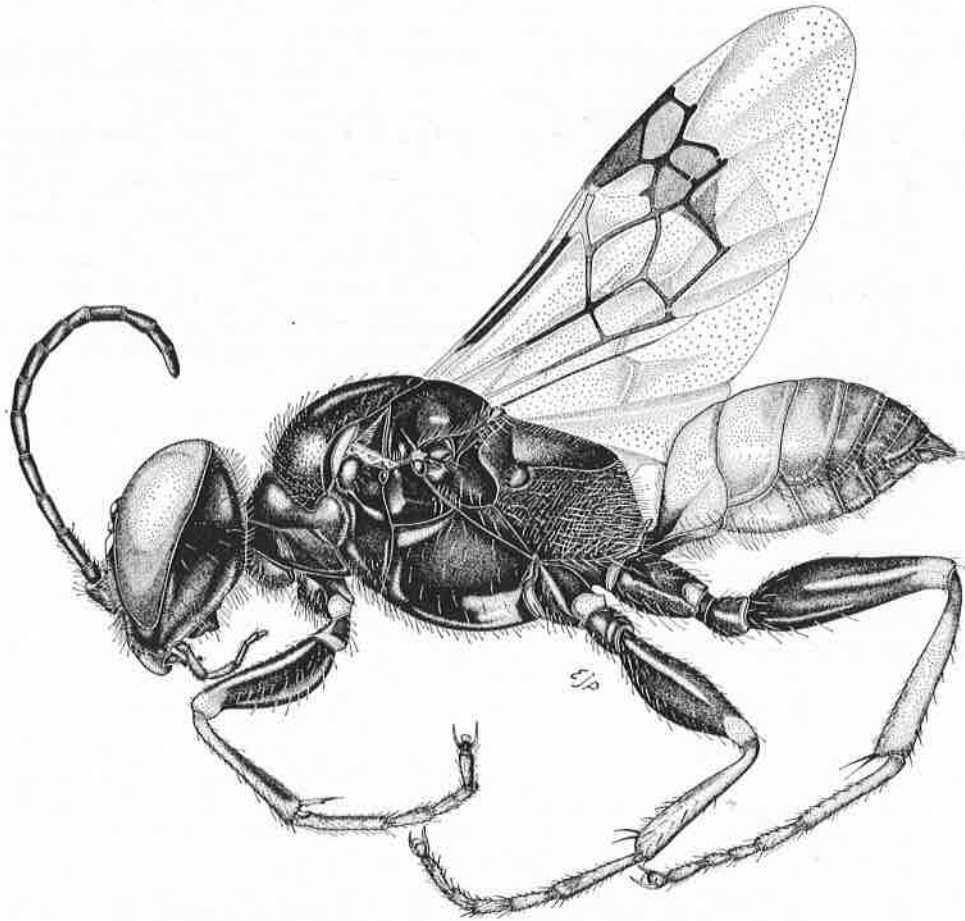
Systematics.—This small xeric species is easily separable from other *Dryudella* by the following features. Males: no frontal shelf, 1st recurrent vein interstitial or nearly so, brown staining in the area of the forewing marginal cell; female: body all red.

Patton (1895) synonymized this species with *montana*, but Williams (1946) correctly considered the two were distinct. When they are critically compared, they are obviously different.

The 2 sexes are quite dimorphic; the previously undescribed females are uncommon in collections, and this scarcity is probably a reflection of their withdrawing habits. Those I have collected were seen crawling among the stems of low-growing or prostrate desert plants, such as *Verbena* and *Euphorbia*.

Range.—Deserts of western North America extending south from Idaho to Arizona and New Mexico. (Fig. 60).

Material Examined.—51 ♂, 10 ♀, April-October.

FIG. 67.—Side view of *D. bella* male.

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