

also noted for these additional male specimens from Topanga Canyon: 4.7 miles N Topanga Beach, Topanga Canyon, Los Angeles County, California; two males, 19 December 1965 and 7 April 1966 (T. Briggs and V. Lee).

FOOD HABITS

Several adult female *Trithyreus pentapeltis* were maintained in the laboratory for more than seven months in a small jar with a wet sponge on the bottom. Initially they were observed to feed on the viscera of sliced *Tenebrio molitor* larvae, but they seemed to prefer very small termites. Three specimens survived for five months without food.

Oregon *Diplotaxis* with Descriptions of the Larvae of Four Common Species and Notes on Biology¹ (Coleoptera: Scarabaeidae)

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Five species of the melolonthine genus *Diplotaxis* were listed in Vaurie's 1960 monograph as occurring in Oregon. These were *Diplotaxis brevicollis* LeConte, *D. conformis* Fall, *D. obscura* LeConte, *D. subangulata* LeConte, and *D. tenebrosa* Fall. In 1962, three additional species, *D. insignis* LeConte, *D. residua* Fall, and *D. sierrae* Fall, were listed from Oregon (Vaurie, 1962) making a total of eight species now known to occur in the state.

Diplotaxis are rarely taken in western Oregon but are quite common in the desert areas of Oregon, east of the Cascade Mountains. *Diplotaxis brevicollis*, *D. obscura*, *D. sierrae*, and *D. subangulata* are sometimes abundant while *D. insignis* is uncommon. *D. conformis*, *D. tenebrosa* Fall, and *D. residua* Fall are rare.

D. sierrae is most abundant in the juniper country of Deschutes County, between Redmond and Bend, Oregon, and is locally abundant in Crook County. *D. subangulata* is quite abundant in Umatilla and Lake counties while *D. insignis* is known only from Lake County, east

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of Silver Lake, Oregon. *D. obscura* is most abundant in Deschutes County.

Adult *Diplotaxis* are nocturnal and are readily attracted to lighted windows and to black light traps during June and July. Adults of *D. sierrae* have been observed feeding on juniper; those of *D. subangulata* feed on sagebrush.

The fact that *Diplotaxis* larvae occur in harvester ant nests was first discovered in August 1954, when Dr. W. F. Barr of the University of Idaho sent me some unknown scarab larvae from ants' nests near Malta, Idaho. Since then, both larvae and adults of *D. sierrae* Fall, *D. subangulata* LeConte, and *D. insignis* LeConte have been collected in central Oregon, from soil beneath mounds of the harvester ant *Pogonomyrmex owyheeii* Cole. On one occasion, 18 teneral adults and two pupae of *D. obscura* LeConte were found in a brushy nest of *Formica integra tahoensis* Wheeler (ants identified by A. C. Cole).

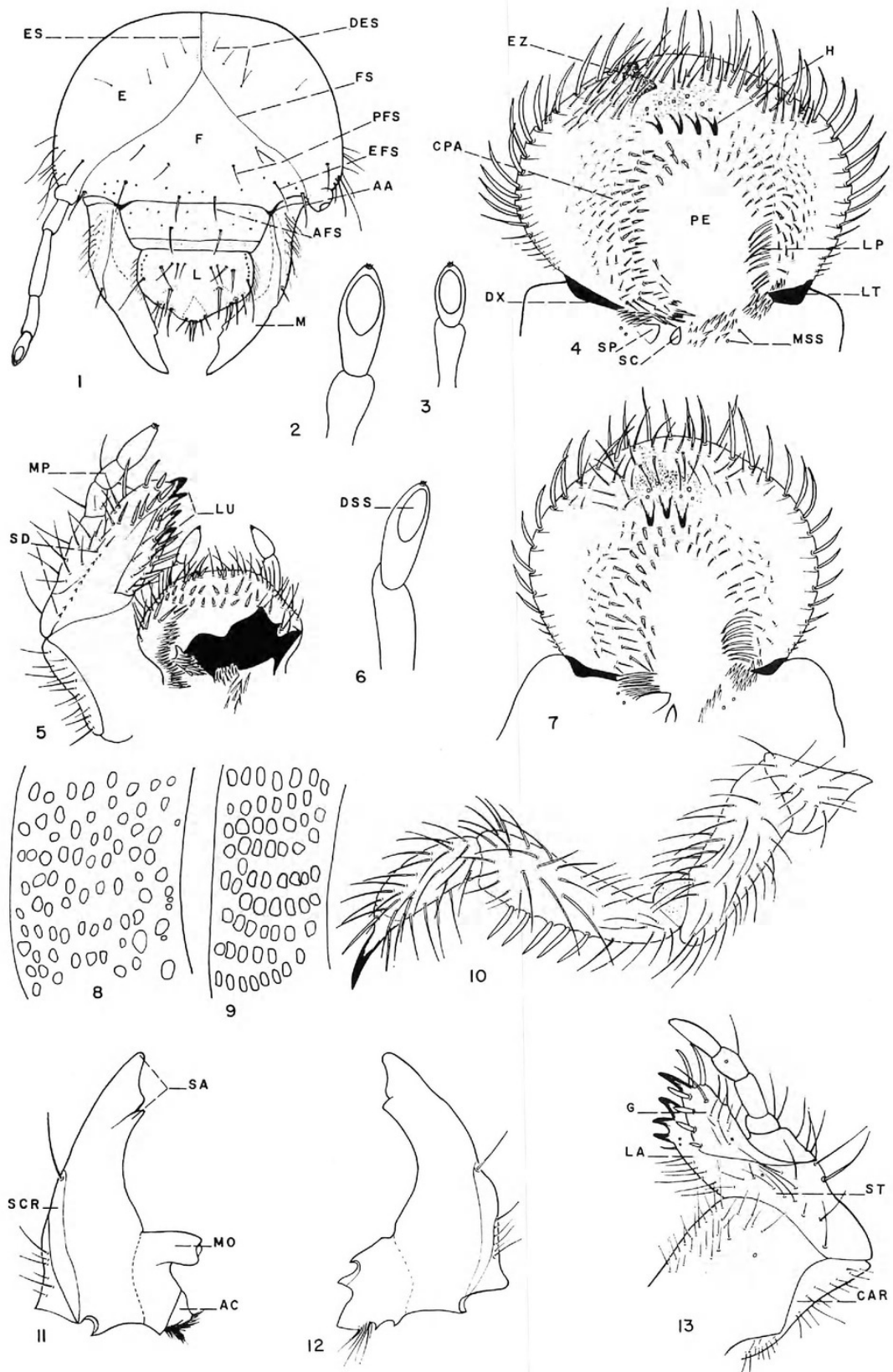
Larvae of *D. sierrae*, *D. subangulata*, and *D. obscura* also occur elsewhere in the soil, often beneath grass roots, where they are neither close to nor associated with ant nests. Larvae of *D. brevicollis* have been found only in the soil of a pine woodland and were not associated with ants.

Pupation occurs during late May, June, and July. Adults overwinter in the soil and are in flight the following spring and summer. Since both larvae and adults of *D. sierrae* are found in the soil in the winter, this species, at least, has a 2-year life cycle.

Larvae of the genus *Diplotaxis* have been characterized by Hayes (1929) and Ritcher (1949). Based on a study of *Diplotaxis* larvae from Oregon, Arizona, and North Carolina, the larval description has been slightly emended as follows: Head without eyespots. Labrum symmetrical with a curved transverse ridge. Epipharynx with plegmatia; proplegmatia absent. Haptomerum with three to five stout heli in a transverse row. Haptotachus without microsensilla. Maxillary stridulatory area with 10 to 16 blunt teeth. Lacinia with a longitudinal row of three unci; distal uncus slightly larger.

Anal opening Y-shaped with stem of Y equal in length to arms of Y. Anal lobes setose. Lower anal lobes triangular, almost equal in size to the dorsal anal lobe. Raster posteriorly with a curved transverse palidium of long, often flattened, caudomesally directed, mustachelike setae, just anterior to each lower anal lobe.³ Anterior to palidium, on each side, with a patch of hamate, tegillar setae. Ventral surface of prothoracic femora with a longitudinal row of five spinelike fossorial setae.

³ The larva of *Serica* also has a transverse palidium but the pali are parallel and caudally directed.



Claws long on prothoracic and mesothoracic legs, very short on metathoracic legs.

Larvae of five common Oregon species may be separated by means of the following key. This key and the descriptions which follow demonstrate that the species of this genus possess larval characters which may be used for their separation.

KEY TO LARVAE OF COMMON OREGON DIPLLOTAXIS

1. All abdominal spiracles similar in size or smaller on abdominal segment 8 2
Spiracles similar in size on anterior 5 or 6 abdominal segments, smaller on abdominal segments 6 to 8 or 7 and 8 3
2. Palidium set with broad, flattened, pali which are conspicuously larger than any of the tegillar setae *D. sierrae*
Palidium set with pali which are not much larger than some of the tegillar setae *D. subangulata*
3. Spiracles reduced in size on abdominal segments 7 and 8. Anterior part of frons ridged *D. insignis*
Spiracles reduced in size on abdominal segments 6 to 8. Anterior part of frons not ridged 4
4. Venter of last abdominal segment with a patch of 45 to 53 tegillar setae, on each side. "Holes" of thoracic spiracle oval to elliptical, not in definite rows *D. obscura*
Venter of last abdominal segment with a patch of 32 to 40 tegillar setae, on each side. "Holes" of thoracic spiracle quadrate and partly in definite rows *D. brevicollis*

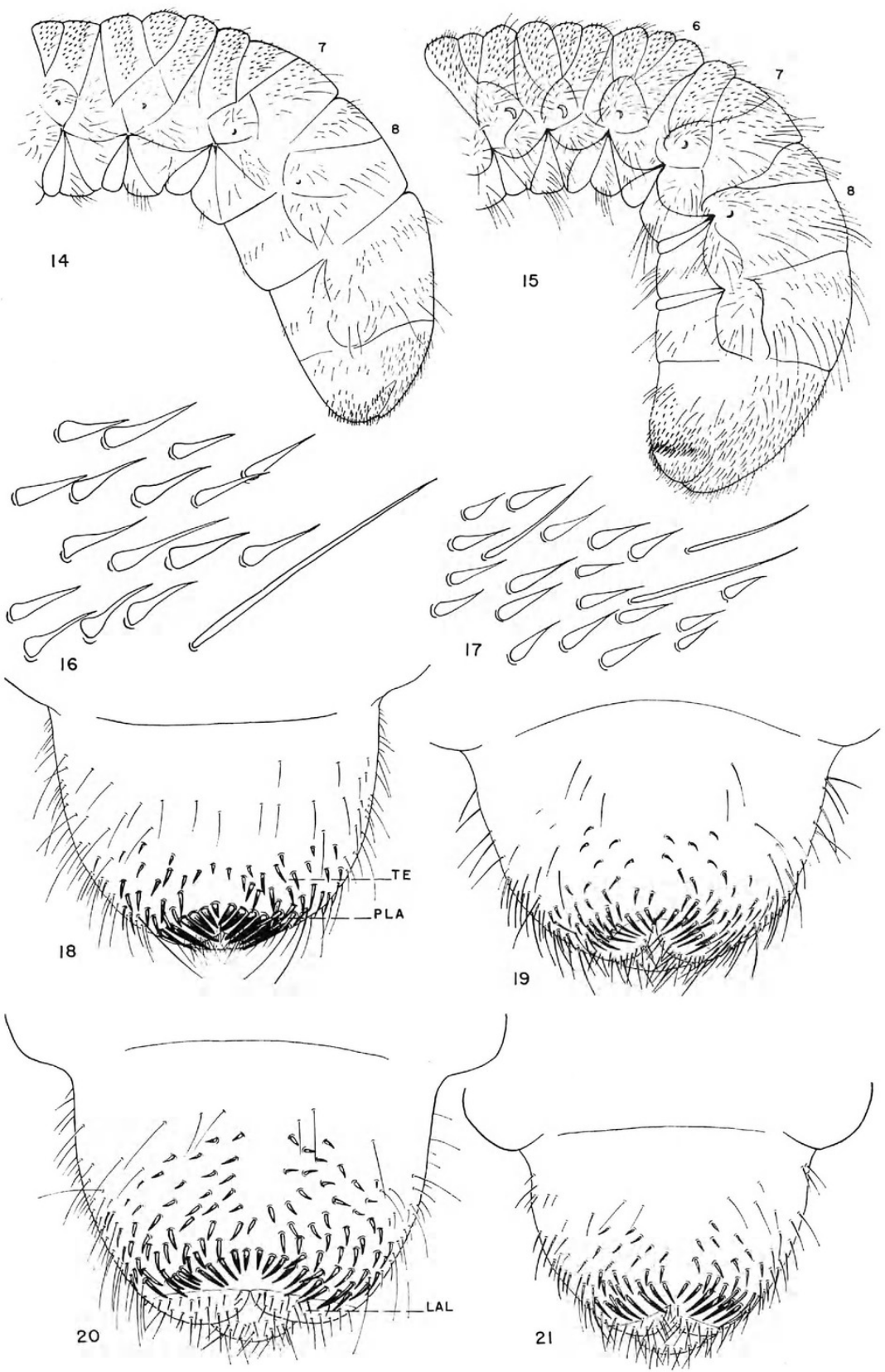
DIPLLOTAXIS OBSCURA LeConte, Third-stage Larva

(Figs. 2, 8, 15, and 20)

Description based on the following material: Three third-stage larvae and cast skins of two third-stage larvae reared to the adult stage. Larvae

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FIG. 1. *D. sierrae*, head. AA, anterior angle seta; AFS, anterior frontal seta; DES, dorsoepicranial setae; E, epicranium; EFS, exterior frontal seta; ES, epicranial suture; F, frons; FS, frontal suture; L, labrum; M, mandible; PFS, posterior frontal setae. FIG. 2. *D. obscura*, last segment of antenna. FIG. 3. *D. subangulata*, last segment of antenna. FIG. 4. *D. sierrae* epipharynx. CPA, chaetoparia; DX, dexiophoba; EZ, epizygum; H, helus; LP, laeophoba; LT, laeotorma; MSS, macrosensilla; PE, pedium; SC, sense cone; SP, sclerotized plate. FIG. 5. *D. subangulata*, left maxilla and labium, dorsal view. LU, lacinial unci; MP, maxillary palpus; SD, stridulatory area. FIG. 6. *D. sierrae*, last segment of antenna. DSS, dorsal sensory spot. FIG. 7. *D. subangulata*, epipharynx. FIG. 8. *D. obscura*, portion of thoracic spiracle. FIG. 9. *D. brevicollis*, portion of thoracic spiracle. FIG. 10. *D. sierrae*, prothoracic leg. FIG. 11. *D. subangulata*, left mandible, dorsal view. AC, acia; MO, molar area; SA, scissorial area; SCR, scrobis. FIG. 12. *D. subangulata*, right mandible, dorsal view. FIG. 13. *D. sierrae*, left maxilla, ventral view. CAR, cardo; G, galea; LA, lacinia; ST, stipes.



collected under sod, east of Arnold Ice Cave, Deschutes County, Oregon, 27 April 1957, by P. O. Ritcher. Adults identified by Vaurie.

Head, yellow brown, faintly shagreened. Maximum width 3.0 to 3.2 mm. Frontal setae, on each side, consisting of one anterior frontal seta, one anterior angle seta, one exterior frontal seta, and an oblique pair of posterior frontal setae. Hap-tomerum of epipharynx with four or five prominent heli arranged in a curved tranverse row. Plegmatia and chaetoparia like those of *D. sierrae*. Phoba along left posterior margin of pedium with 6 to 9 curved, branched filaments. Other phobae also very similar to those of *D. sierrae*. Maxillary stridulatory area with 11 to 16 sharp, slightly curved teeth.

Thoracic spiracle with respiratory plate from 0.26 to 0.28 mm long and 0.11 to 0.15 mm wide, arms of respiratory plate not constricted. Respiratory plate with 9 to 11 oval to elliptical holes along any diameter; not in definite rows. Spiracles on abdominal segments 1 to 5 similar in size, arms of respiratory plate slightly constricted. Spiracles on abdominal segments 6 to 8 much smaller, with respiratory plates not constricted. Abdominal segments 2 to 6 each with three dorsal folds, each closely set with short setae and posteriorly with long, slender setae. Dorsa of abdominal segments 8 and 9 each with two sparsely set transverse patches of slender setae of which the posterior setae are the longest. Raster mustachelike with a curved, transverse row (palidium) of 10 to 16 fairly long, caudomesally directed, sharp, flattened setae, just cephalad of the lower anal lobes. Also, with a large patch of 45 to 53 flattened setae, on each side, extending forward from the palidium which are similar in size to those of the palidium posteriorly but decrease in size anteriorly. Tegillar setae extending cephalad at least half the distance to the posterior margin of the second abdominal segment and separated anteriorly into two subtriangular patches. Anterior tegillar setae compressed at tips and directed laterad.

DIPLLOTAXIS SIERRAE Fall, Third-stage Larvae

(Figs. 1, 4, 6, 10, 13, 16, and 18)

Description based on the following material: (1) Two third-stage larvae and exuviae of nine third-stage larvae reared to the adult stage. Larvae collected in June 1961, 7 miles north of Tumalo, Oregon, under harvester ant nests by David Smith and P. O. Ritcher. Adults identified by Vaurie. (2) Eight third-stage larvae and exuvia of three third-stage larvae reared to the adult stage. Larvae collected in June 1961, 13 miles

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FIG. 14. *D. subangulata*, abdominal segments 5 to 10, left lateral view. FIG. 15. *D. obscura*, abdominal segments 4 to 10, left lateral view.

FIG. 16. *D. sierrae*, enlarged view of tergal setae typical of abdominal segments 2 to 6. FIG. 17. *D. subangulata*, enlarged view of tergal setae typical of abdominal segments 2 to 6. FIG. 18. *D. sierrae*, palidium; TE, tegillar setae; PLA, palidium. FIG. 19. *D. insignis*, venter of last abdominal segment. FIG. 20. *D. obscura*, venter of last abdominal segment. LAL, lower anal lobe. FIG. 21. *D. subangulata*, venter of last abdominal segment.

southeast of Sisters, Oregon, under harvester ant nests, by David Smith. Adults identified by Vaurie.

Head yellow brown in color, faintly shagreened. Maximum width 2.9 to 3.1 mm. Frons, on each side, with one anterior frontal seta, one anterior angle seta, one exterior frontal seta, and an oblique pair (rarely 3) of posterior frontal setae. With a row of two or three epicranial setae. Eyespots absent. Labrum symmetrical, slightly wider than long, faintly trilobed. Haptomerum of epipharynx with three or four stout heli, arranged in a transverse row. Anterior of the heli is a curved row of six macrosensilla. Epizygum present; zygum absent. Plegmatia present with eight to ten well-developed plegma on each side. Chaetoparia well developed, with very few or no sensilla. Posterior part of pedium on the left side, fringed with a phoba of 10 or 11 long, curved, branched filaments. Pedium fringed posteriorly, on the right side, with a phoba which is dense posteriorly and sparsely set anteriorly. Both nesia present. With a dense, double-rowed phoba between the inner end of the dextiotorma and the sclerotized plate, and with another dense phoba just behind the inner end of the laetorma. Haptolachus, between the sense cone and left pair of macrosensilla, densely covered with 25 to 50 spinules. Mandibles slender. Scissorial area bladeliike and with a posterior tooth behind the scissorial notch. Lateral face of each mandible with a patch of 13 to 15 setae. Maxilla with galea and lacinia fused basally but free apically. Ventral surface of galea with a longitudinal row of four or five stout setae. Lacinia with three unci arranged in a longitudinal row. Maxillary stridulatory area consisting of a row of 12 or 13 sharp-pointed teeth. Last antennal segment with a single, large, elliptical sensory "spot" which is almost as long as the distance from the caudal margin of the spot to the caudal margin of the segment.

Respiratory plate of thoracic spiracle from 0.26 to 0.28 long and 0.17 to 0.18 mm wide. Arms of respiratory plate not or only slightly constricted. With 8 to 12 ovate to elliptical holes along any diameter; holes not in definite rows. Spiracles similar in size on abdominal segments 1 to 7, much smaller on abdominal segment 8. Each dorsal fold of abdominal segments 2 to 6 with a dense covering of rather short, stout setae and posteriorly with scattered, long slender setae. Short, stout seta with straight sides when viewed from above, some keel-like dorsally when viewed from the side. Venter of last abdominal segment with a mustachelike raster consisting of a transverse group of 6 to 9 long, stout, flat, caudomesally directed setae, on each side, just anterior to the lower anal lobes. These prominent setae, together with the 30 to 40 scattered, mostly shorter, hamate setae located anteriorly, cover only the posterior third of the venter of the last abdominal segment. Tegillar setae flattened and directed caudad or somewhat latero-caudad. Anal slit Y-shaped with stem of Y shorter than arms. Lower anal lobes and upper anal lobe setose. Claws long on prothoracic and mesothoracic legs, short on meta-thoracic legs. Each claw bearing two setae.

DIPLOTAXIS SUBANGULATA LeConte, Third-stage Larva

(Figs. 3, 5, 7, 11, 12, 14, 17, and 21)

Description based on the following material: (1) Seventeen third-stage larvae and cast skins of eight third-stage larvae reared to the adult stage. Larvae collected 13 June 1963 (nine larvae) and 27 June 1963

(16 larvae) 10 miles north of Hermiston, Oregon, Umatilla County, in soil beneath *Artemesia tridentata*, by Charles Baker. (2) Cast skin of third-stage larvae found with pupa which was reared to the adult stage. Pupa found 11 miles southeast of Princeton, Oregon, Harney County, 18 July 1961, by P. O. Ritcher, under harvester ant nest. Adult identified by Vaurie.

Head yellowish, maximum width 2.0 to 2.2 mm. Frons, on each side, with one anterior frontal seta, one anterior angle seta, one exterior frontal seta, and an oblique pair of posterior frontal setae. Epicranial setae two or three in number, on each side. Haptomerum of epipharynx with three heli. Plegmatia present, with 8 to 10 well-developed plegma. Inner half of each chaetoparia set with stout, spinelike setae; outer half set with small, short setae. Laeophoba along left posterior margin of pedium with four to six curved, branched filaments. Dexiophoba, along right posterior margin of pedium, sparsely set with about six spine-like filaments. Haptolachus of epipharynx with a long dense phoba between the inner end of the dextortorma and the sclerotized plate. Also with a dense phoba just posterior to the inner end of the laeophoba. Area between sense cone and left pair of macrosensilla with a row of 5 to 10 spinules. Maxillary stridulatory area with a row of 10 to 14 conical teeth. Distance between caudal margin of dorsal sensory spot on last antennal segment and the caudal margin of the segment about one-third of the length of the spot.

Thoracic spiracle much larger than abdominal spiracles. Thoracic spiracle with arms of respiratory plate not constricted, from 0.15 to 0.18 mm long and from 0.17 to 0.11 mm wide. With four to eight ovate to oblong holes along any diameter of the respiratory plate. Spiracles on abdominal segments 1 to 7 all similar in size, those on abdominal segment 8 slightly smaller. Each of the three dorsal folds on abdominal segments 2 to 6 has a transverse patch of short, bulbous setae with long, slender setae posteriorly. Bulbous setae very sparse on the scutum of abdominal segment 7 and absent on abdominal segment 8. Raster mustachelike with a vague transverse palidium which is not too different from the adjacent tegillar setae. Palidium consisting of an oblique row of six to eight long, caudomesally directed setae, on each side, anterior to the lower anal lobes. Anterior to the palidium, on each side, is a triangular patch of 25 to 35 flattened tegillar setae which extends less than halfway to the caudal margin of the second abdominal segment. Posterior 12 to 15 tegillar setae, on each side, only slightly shorter than the pali. Claws of prothoracic legs longer than claws on mesothoracic legs.

DILOTAXIS INSIGNIS Fall, Third-stage Larva

(Fig. 19)

Description based on the following material: (1) Four third-stage larvae and cast skin of one third-stage larva associated with a pupa. Larvae collected from soil beneath harvester ant nest, 16 miles north-east of Silver Lake, Oregon, 16 May 1957, by P. O. Ritcher, No. 57-2A. (2) Cast skins of five larvae reared to the adult stage. Larvae taken beneath harvester ant nests, 10 miles north of Silver Lake, Oregon, 6 July 1962, by David Smith. Adults identified by Vaurie in 1965.

Maximum width of cranium 3.3 to 3.4 mm. Frontal setae, on each side, with one anterior frontal seta, one anterior angle seta, one exterior frontal seta, and an oblique pair of posterior frontal setae. Anterior part of frons broadly ridged. With two epicranial setae, on each side. Haptomerum of epipharynx with three stout heli. Epizygum present. Each plegmatium, with seven or eight well-developed plegma. Chaetoparia well developed; right chaetoparium with much stouter setae than left. Posterior part of pedium on left side, fringed with a phoba of 8 to 10 curved, branched filaments. Haptolachus as in *D. sierrae*. Mandibles and maxillae similar to those of *D. sierrae*. Maxillary stridulatory teeth consisting of a row of 10 to 15 sharp-pointed teeth. Last antennal segment as in *D. sierrae*.

Respiratory plate of thoracic spiracle from 0.26 to 0.31 long and 0.18 to 0.20 wide, arms of respiratory plate only slightly constricted. With 10 to 15 ovate to elliptical holes along any diameter; holes sometimes in irregular rows. Spiracles similar in size on abdominal segments 1 to 6, smaller on abdominal segments 7 and 8. Short, stout setae on dorsal folds, slightly bulbous at base or with slight keel dorsally when viewed from the side. Venter of last abdominal segments with a mustachelike raster consisting of a transverse semicircle of 12 or 13, moderately long, caudomesally directed setae and anteriorly on each side, with a patch of 19 to 27 long flattened setae. Also, anterior to the latter, are four to eight sparsely set short, stout hamate setae, on each side, whose tips bend laterally. Entire raster, including short hamate setae, covering less than the posterior half of the venter of the last abdominal segment. Anal slit, anal lobes, and claws as in *D. sierrae*.

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