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NEARCTIC DESERT DECTICIDAE (ORTHOPTERA)
PART III THE TRUE TYMPANUM IN CERTAIN
GENERA WITH KEY

Ernest R. Tinkham¹

This is a report on the nature of the true tympanum in Dectricidae, its location and taxonomic value. The dectricids are a most difficult group to evaluate generically, and any new character that will aid in defining and keying out genera should be of definite taxonomic value in addition to adding to our knowledge on sound reception in these most interesting creatures.

Apparently no recognition has been given in the literature to the location and character of the true tympanum in the Dectricidae or related Tettigonoidea or in the Oecanthidae or other orthopteroid families. Textbooks have for many decades illustrated and described the tympanum as located in the basal portion of the protibia where there is a small, hollow, swollen area with internal and external longitudinal slots that are supposed to permit the entrance of sound vibrations. All members of the Tettigonoidea that stridulate are supposed to possess this protibial organ.

Fulton (1928) conducted experiments on certain tettigoniids, including *Neoconocephalus nebrascensis*, *Amblycorypha rotundifolia brachyptera*, and *Oecanthus niveus*, in which half of his caged specimens had their fore tibiae amputated at their bases; the checks were normal. His experiments proved that those with amputated protibiae could still hear but that an asynchronization had developed, while in the control or untreated cages synchronization of stridulation to distant stridulating males proceeded normally. These experiments indicated that tettigoniids and oecanthids with snipped-off fore tibiae could still hear, but the obvious meaning was obscured. Fulton summarized his conclusions thus: "The tympanal organs of the front tibiae are auditory organs, an assumption based on circumstantial evidence of their structure and the fact that they are present in all stridulating species."

It is obvious that such an assumption can be erroneous. It is like amputating the arms but not observing the ears which hear. Certainly, dectricids, tettigoniids, oecanthids, and others can still hear sound, even with their front legs cut off, because the tympana are present on the thoraces of these creatures.

Snodgrass (1925) states that "if they [protibial organs] are not ears what are they?"

Such assumptions and conclusions can explain the oversight in recognizing the true tympanum. Obviously, the protibial organ in the dectricids, tettigoniids, and oecanthids, as shown by Dr. Fulton's experiments, must be a substation or synchronometer that interprets and passes on the sound received by the true tympanum, herein de-

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scribed as located on the thorax, and flashes on a response to the tegmina, which stridulate their challenge to the producer of the received sound or song.

That the organ which lies just caudad of the prothoracic spiracle is the tympanum is further corroborated by the position of the tympanum in all those sound-producing acridids in many subfamilies of grasshoppers, where its location is just caudad of the metathoracic spiracle and only two segments removed from that in the Decticinae and just above the metacoxal joint of the hind leg.

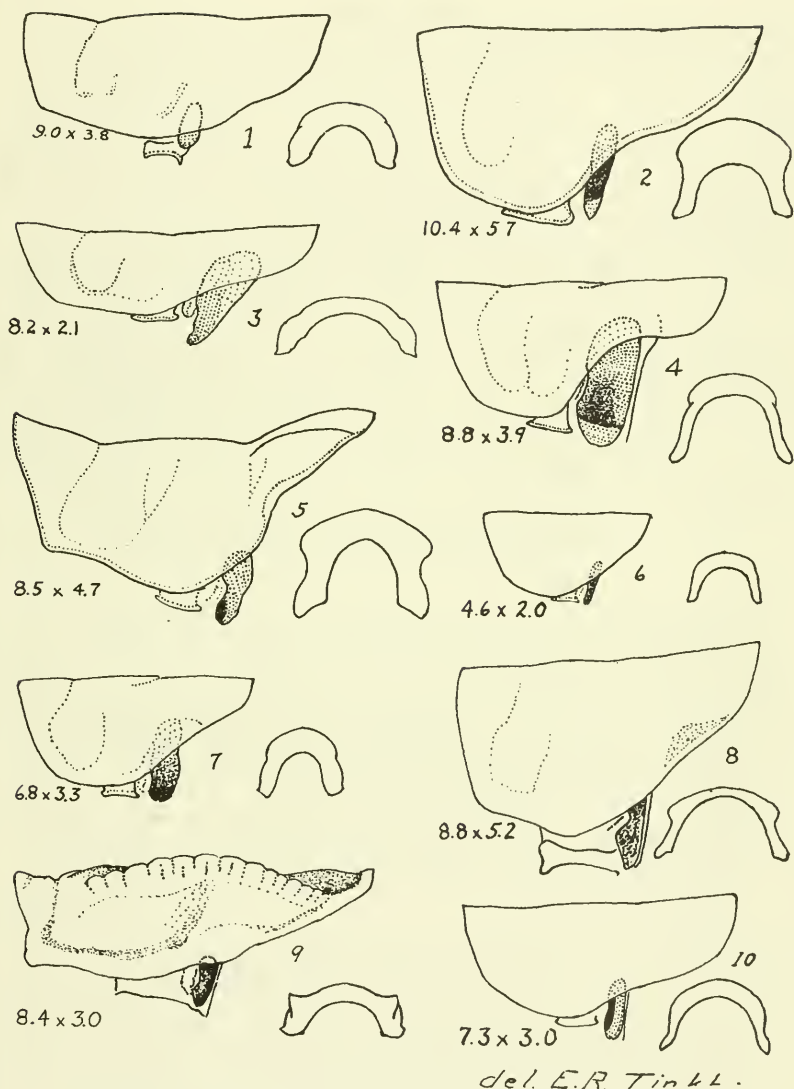
It is interesting to note that the two new genera recently described by the author, namely, *Petropedes* and *Platyoplus*, portray the greatest development of the tympanum, but nature exhibits two different ways to increase the receptivity of sound. In *Platyoplus* (Figure 3) though the pronotum is very broad and very shallow, it still hides half of the very large, auricular-shaped tympanum. To overcome this effect, the pronotum just above the covered upper portion of the tympanum at the posteroventral emargination of the lateral lobes is convexly swollen to facilitate the penetration or reception of sound. On the other hand, in *Petropedes* (Figure 4) although the lateral lobes are very deep, the posteroventral margin is more strongly emarginate or excised than in any other eremicolous dectid genus, so that the huge tympanum is almost completely exposed for the reception of sound.

Although both genera possess a very large tympanum, relationship stops at this point; for the two genera represent two different sections of the Decticinae. *Platyoplus* apparently has its nearest relationships with *Ateloplus*, especially the largest species *A. splendidus*, whereas *Petropedes* seems allied to *Inyodectes* and perhaps *Eremopedes* and *Pediodyctes* as well.

Likewise, it is interesting to note that both recently described genera inhabit barren, inhospitable rocky mountain slopes under a blazing sun, and the enormous tympana would appear to be adaptations to such an environment. *Inyodectes* (Figure 7) seems to bear out this observation, for it also has a relatively large tympanum in relationship to its medium size. Although it does not dwell in such a hot desert as *Petropedes* and *Platyoplus*, which are both members of the fauna of the hottest desert, the Colorado, it does dwell in piles of rocks at the base of talus slopes in the western portions of West-guard Pass at about the lower limits of the pines in the Inyo Mountains, which likewise, because they lie in the rainshadow of the Sierra Nevadas, are very barren and xeric.

In *Ateloplus* (Figure 1), a review of the known species shows that the tympanum is oval in shape and not as large or expanded in its upper half as in *Platyoplus*. In *Ateloplus*, the species *A. schwarzi* and *A. notatus* show tympana that are roundly oval in shape; whereas in *A. hesperus*, *A. luteus*, *A. minor*, and *A. splendidus*, the tympana are more narrowly elliptical in relationship to their size.

In *Eremopedes* (Figures 2, 10), the tympana range from a narrow elliptical slit in *E. shrevei*, *E. balli*, *E. covilleae*, *E. ephippiata*,



Figs. 1-10. Dectid pronota as seen in lateral aspect and cross-sections from cephalic aspect: 1, *Ateloplus splendidus*, male topotype; 2, *Eremopedes ephippiatus sonorensis*, male holotype; 3, *Platyoplus gilaensis*, holotype; 4, *Petropedes santarosa*, holotype; 5, *Capnobotes fuliginosus*, male, Mulligan Canyon, Franklin Mts., Texas; 6, *Oreopedes cryptoptera*, female, Westguard Pass; 7, *Inyodectes pallidus*, female topotype, Westguard Pass; 8, *Zacycloptera atripennis*, topotype, Walker Lake, Nevada; 9, *Plagiostira utahensis*, female, western Utah; 10, *Eremopedes bilineatus*, male, Santa Ana, Sonora, Mexico.

and *E. pallidus* to a narrowly oval form in *E. bilineatus*, *E. scudderi*, and *E. ephippiata sonorensis*.

In most of the other genera, such as *Oreopedes* (Figure 6), *Capnobotes* (Figure 5), *Zacycloptera* (Figure 8), *Plagiostira* (Figure 9), *Neduba*, and *Aglaothorax*, the tympana are rather oval elliptical, and some of these, especially *Zacycloptera*, *Plagiostira*, and *Capnobotes*, have the fore margin of the tympanum quite irregular due to the presence of the prothoracic spiracle.

Another feature of the tympanum that should be noted here is whether its periphery is bare or lined with an even row of very fine, short-tapered hairs. In *Platyoplus*, *Petropedes*, *Inyodectes*, *Capnobotes*, and *Anoplodusa*, the peripheral margin is barren of any minute hairs; in *Ateloplus*, the margin is very finely hirsute in the smaller species but bare in *A. splendidus*, the largest species; in *Oreopedes*, the margin is very finely hirsute; in *Eremopedes*, it is barren in some species and hirsute in others. The function of these hairs is not known or surmised at this time; a study of their function and structure would be most interesting and perhaps revealing.

KEY TO CERTAIN EREMICOLOUS GENERA BASED ON TYMPANA AND PRONOTA

1. Tympanum extremely large, located at or near situation of posteroventral margin of lateral lobes of pronotum 2
Tympana mostly medium to small in size 3
2. Tympanum enormous, broadly oval, and largely exposed by strongly excavate posteroventral emargination of pronotum, although upper quarter still concealed *Petropedes*
Tympanum very large, auricular in outline, largely concealed by very broad, very shallow lateral lobes of pronotum; pronotum convexly swollen above concealed portion of tympanum *Platyoplus*
3. Pronotum barrel-shaped, without lateral carina 7
Pronotum with partial or complete rounded lateral carinae 4
4. Pronotum extremely large, ovably rounded in dorsal outline, its dorsal surface gently convex 5
Pronotum not as above, more narrowly linear, sometimes quadrate in dorsal outline; dorsal surface irregular 6
5. Pronotum extremely large, oval in dorsal outline, highly colored *Aglaothorax*
Pronotum moderately large, colored more drably *Neduba*
6. Size very large; tegmina and wings far surpassing apex of abdomen; metazona with strongly arched lateral ridge or keel *Capnobotes*

- Size large, tegmina and wings slightly longer than pronotum; lateral carina of pronotum crenulate-arcuate; disc of pronotum irregular *Plagiostira*
7. Size very small *Oreopedes*
 Size medium to larger 8
8. Body large and heavy; wings jet black; tegmina and wings slightly longer than pronotum *Zacycloptera*
 Body much more slender, wings not black; tegmina and wings shorter than pronotum 9
9. Tympanum relatively large for medium size and half exposed *Inyodectes*
 Tympanum small, usually oval elliptical; size ranging from small to large 10
10. Size mostly medium to large, mostly heavy bodied; pronotum with deep lateral lobes *Eremopedes*
 Size medium large to small; pronotum broad, with disc convex and with rather shallow lateral lobes *Ateloplus*

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