

"EMERIT'S GLANDS" IN *CYBAEOTA* (ARANEAE, AGELENIDAE)

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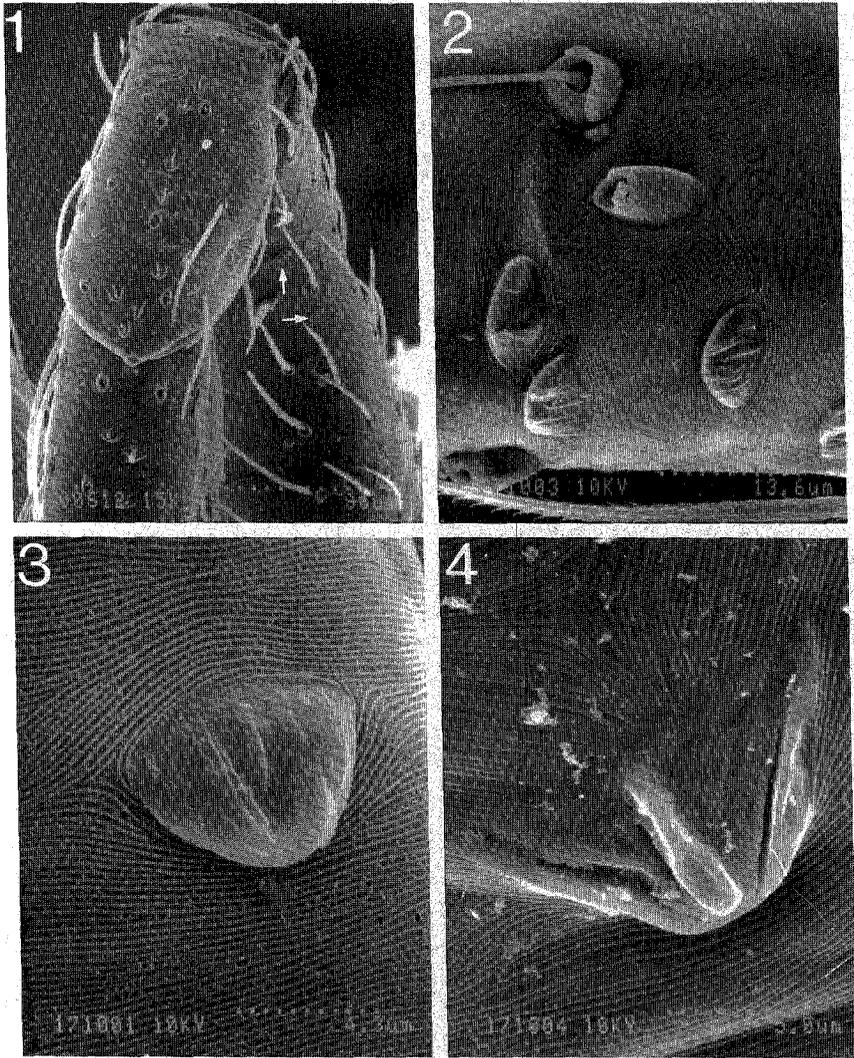
ABSTRACT

A new type of spider integumentary gland with distinctive cuticular morphology was recently described in the Telemidae. Strikingly similar glands have subsequently been found in the Leptonetidae, some Salticidae, and now in the genus *Cybaeota* (Agelenidae). The spatial distribution of the glands in *Cybaeota* is described. Their placement on the bodies of these spiders supports the repugnatorial secretion hypothesis proposed for them in the Telemidae. The phylogenetic implications of the scattered distribution of this character in spiders are discussed.

INTRODUCTION

In 1981 Emerit described a new type of integumentary structure from the legs of the cave-dwelling telemid spider *Telema tenella* Simon. In this spider he found up to twenty tiny "cupules gaufrees", or cuticular plates, randomly distributed along the middorsal length of each tibia (except on the pedipalps). Noting the presence of a minute pore in each, he suggested that the plates are either chemosensors or glands. Later Emerit and Juberthie (1983) demonstrated that the plates are glandular and produce a non-proteinaceous secretion. In two further papers (1984, 1985) Emerit described similar glands from other telemids of the genera *Apneumonella* Fage, *Usofila* Keyserling, *Seychellia* Saaristo, *Cangoderces* Harington, and *Jocquella* Baert. He concluded that the glands are most likely repugnatory in nature in spite of their lack of accumulation reservoirs normally associated with chemical defense secretions (Emerit 1984). In summary Emerit (1985) suggested that these glands are apomorphic for the family Telemidae and divide the family into two groups: *Usofila* plus *Telema* with oval plates (Figs. 2, 3), and the four others with transverse furrows.

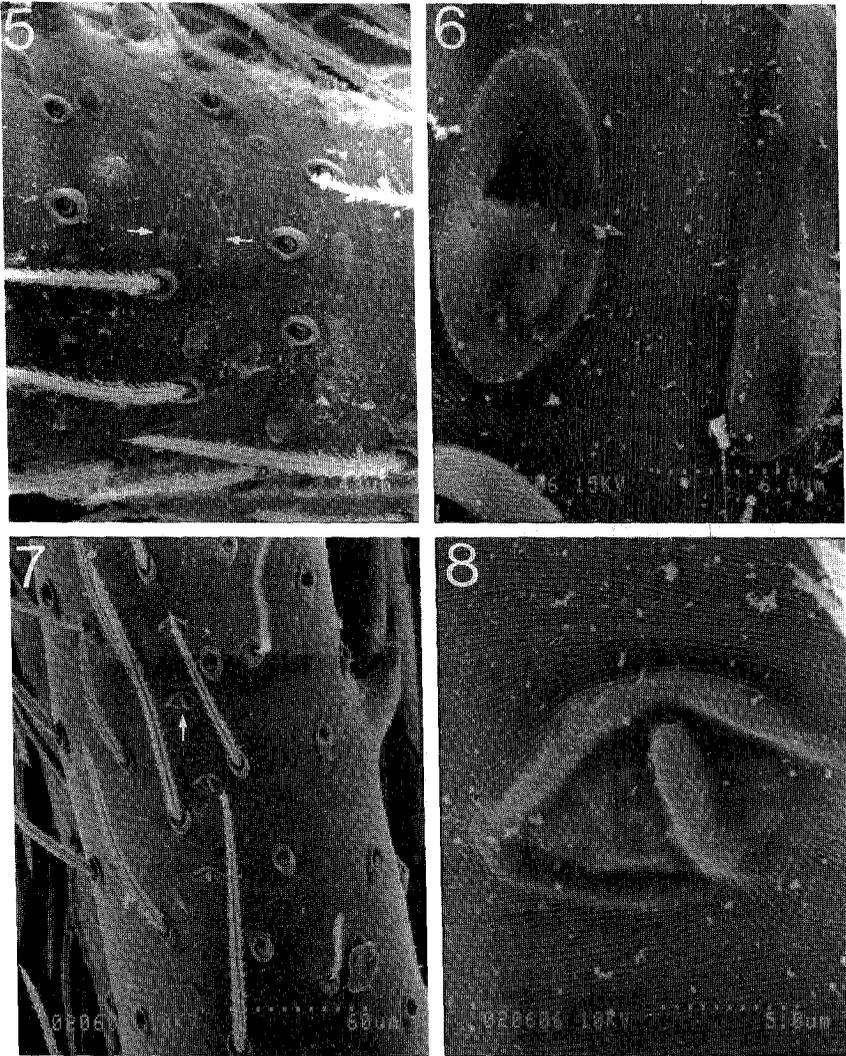
Thinking that perhaps the glands are an adaptation to troglobiosis, Emerit (1984) studied one cave-dwelling leptonetid but found no tibial glands. Platnick, however, observed glands similar to those on *Telema* and *Usofila* on the tibiae of, and Forster found them on the patellae of, some other leptonetid species (Platnick 1986). Platnick (1986) subsequently reviewed the distribution of tibial and patellar glands in the Leptonetidae and concluded that (1) a few leptonetids have oval-type tibial glands, (2) patellar glands, although lacking in the Telemidae, are found in most Leptonetidae, (3) the glands are a synapomorphy of the two families (a previously accepted but cladistically untested sister grouping), and (4) the oval morphology is probably plesiomorphic for the two families.



Figures 1-4.—Emerit's gland distribution in *Cybaeota* spp. and *Telema* sp.: 1, *C. nana*, on tibia, patella, and femur I (arrows indicate two glands on femur); 2, 3, *Telema* sp. (Victoria, British Columbia), dorsally on tibiae; 2, tibia III; 3, tibia I; 4, *C. shastae*, distodorsally on male palpal patella.

Oval glands strikingly similar to those in the telemids and leptonetids are now known to occur in at least two other families. Wanless (1984, 1987) and Wanless and Lubin (1986) have found them in the Salticidae (in a dorsal abdominal cluster in *Portia* Karsch, *Cyrba* Simon, *Cocalus* C. L. Koch, *Mintonia* Wanless, and *Gelotia syringopalpis* Wanless; dorsally on the tibiae in *Spartaeus* Thorell; and on all legs, especially femur I and patella I of males in *Diolenius minotaurus* (Wanless and Lubin). This paper describes them from the cybaeine agelenid genus *Cybaeota* Chamberlin and Ivie.

At least until their true function is determined, it is proposed here that this type of gland be termed "Emerit's glands."

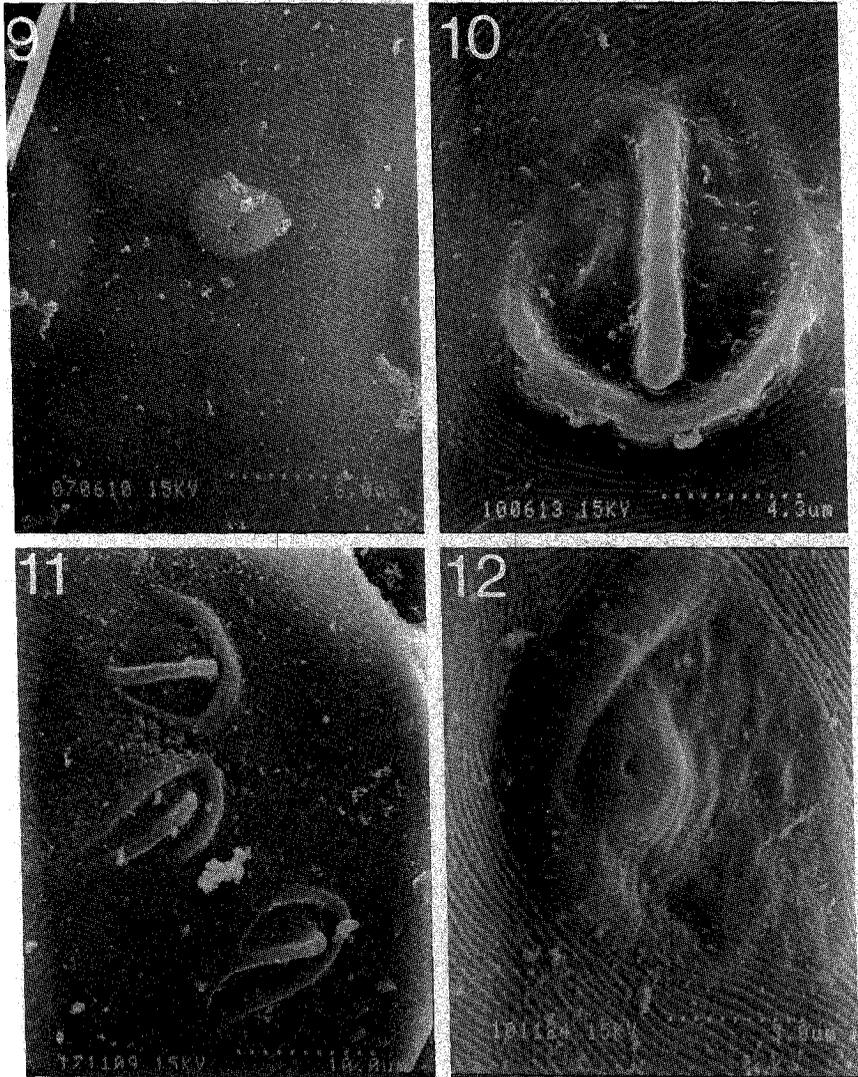


Figures 5-8.—Emerit's gland distribution in *Cybaeota* spp.: 5, 6, *C. calcarata*, proximodorsally on tibia I; 5, at least 20 glands of variable morphology; 6, two glands indicated by arrows in Fig. 5; 7, 8, *C. shastae*, mid-dorsally on tibia I; 7, five glands; 8, gland indicated by arrow in Fig. 7.

EMERIT'S GLANDS IN *CYBAEOTA*
 PLACEMENT, FUNCTION, AND PHYLOGENETIC IMPLICATIONS

During the preparation of a revision of *Cybaeota* (Bennett 1988) oval tibial glands were found on *C. shastae* Chamberlin and Ivie (Figs. 7, 8) which strongly resemble, in morphology and distribution, those of *Usofila*, *Telema*, and the Leptonetidae. Subsequent work with *Cybaeota* has shown that Emerit's glands occur on many parts of the body surface of *C. shastae* and at least two of the three other known species: *C. calcarata* (Emerton) and *C. nana* Chamberlin and Ivie.

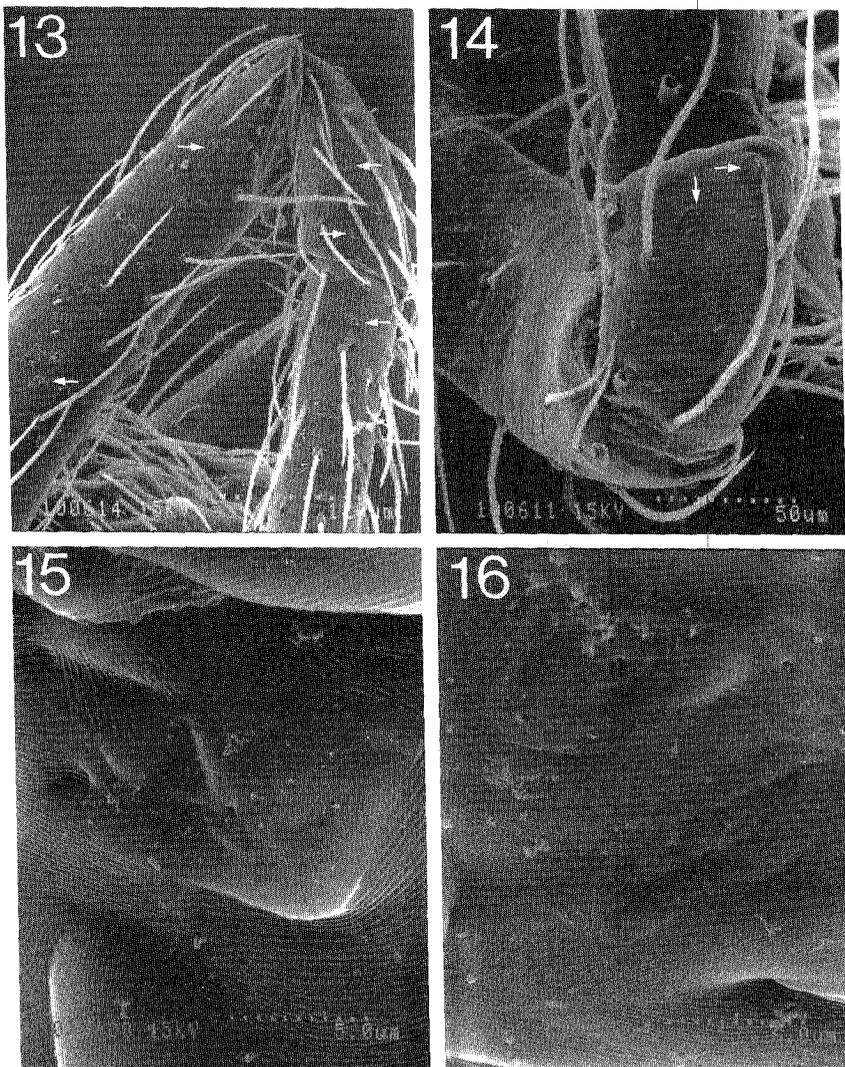
In *Cybaeota* the morphology of Emerit's glands is quite variable. There are three basic variations: distinctively keeled medially (Fig. 1), flattened with little



Figures 9-12.—Emerit's gland distribution in *Cybaeota* spp.: *C. shastae*, on anterior prolateral margin of chelicera; 10-12, distodorsally on patellae; 10, *C. nana*, patella II, female; 11, same, male; 12, *C. calcarata*, patella I.

ornamentation (Fig. 6), and laterally elongated (Fig. 25). However, intermediates and other morphotypes (e.g., Fig. 28) exist. A wide range of variation may be observed on a single specimen. This seems especially true for *C. calcarata* (Fig. 5).

All glands have a single pore which is directed distally on leg segments, anteriorly on the carapace, and posteriorly on the abdomen. The glands are most numerous and heavily concentrated on the legs - dorsally on the tibiae (Figs. 5-8) and patellae (Figs. 1, 10-12) and distolaterally on the femora (Figs. 1, 13) - and adjacent to the eye group (Figs. 17-20, 22). Glands also are encountered sporadically on the dorsal surfaces of the patellae and tibiae of palps (Figs. 4, 14-16), anteriorly on the chelicerae (Figs. 9, 21), ventrally on the coxae of legs (Figs. 25, 26), and dorsally on the abdomen (Figs. 27-29, 31, 32) or rarely ventrally (Fig.

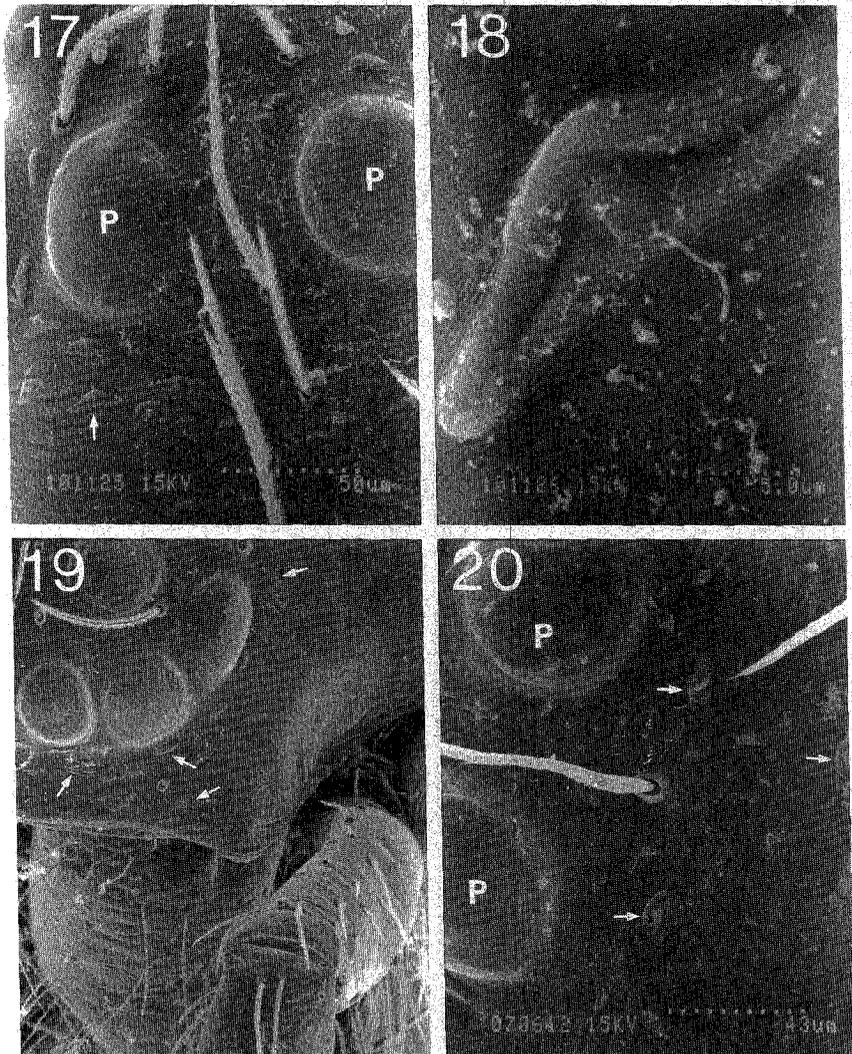


Figures 13-16.—Emerit's gland distribution in *Cybaeota* spp.: 13, *C. nana*, prolaterally on femur, patella, and tibia I (arrows indicate some of at least 20 glands present); 14-16, on female palps; 14, *C. nana*, patella (two glands indicated by arrows); 15, *C. shastae*, proximodorsal margin of tibia; 16, same, distodorsal margin.

30). Glands are also scattered about dorsally on the metatarsi of the legs (Figs. 33-36) and on the carapace (Figs. 23, 24).

In *Cybaeota*, Emerit's glands are unknown on the sternum, trochanters, tarsi, ventrally on leg segments (except the coxae), on the palpi (except as noted above), or dorsally on the femora. As in most other taxa where they are known to occur, the glands are distributed equally among males and females (see Wanless and Lubin 1986).

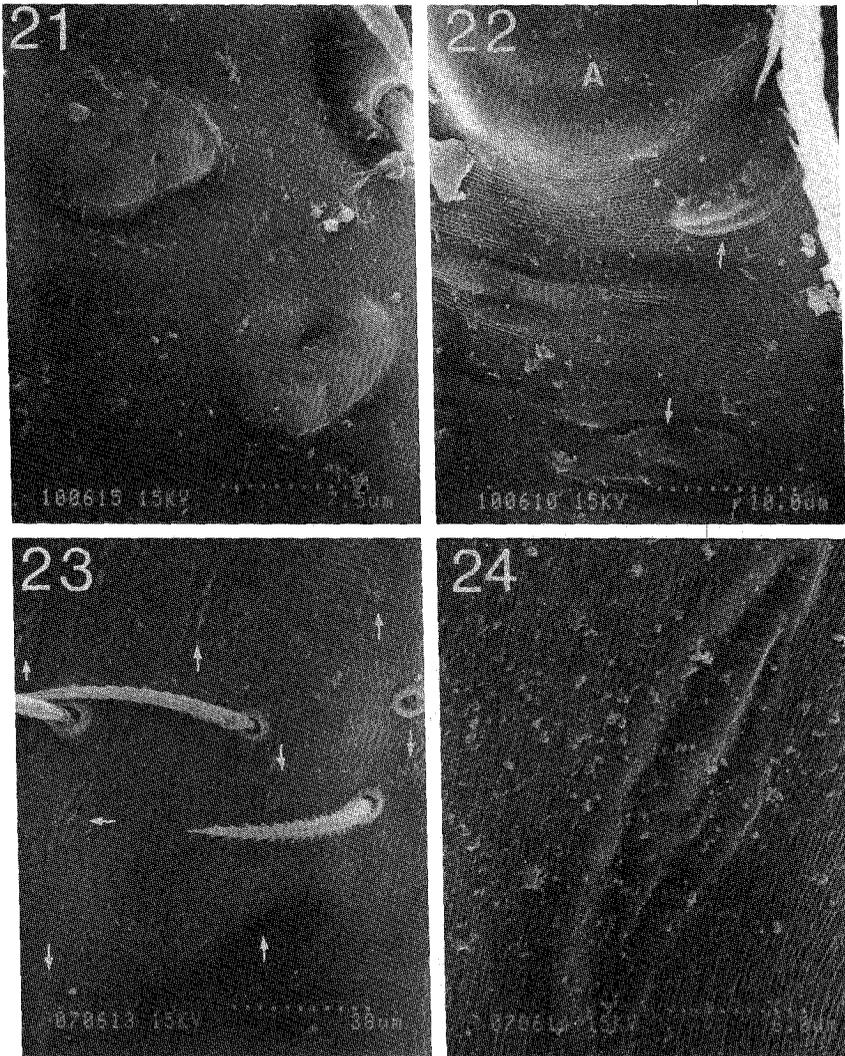
No evidence of Emerit's glands has been found in the following agelenids which exploit habitats similar to those occupied by *Cybaeota*: *Dirksia cinctipes* (Banks), *Ethobuella tuonops* Chamberlin and Ivie, *Cryphoea montana* Emerton, *Cicurina brevis* (Emerton), various species of the genera *Cybaeus* L. Koch and *Cybaeina*



Figures 17-20.—*Cybaeota* spp., Emerit's glands around eyes: 17, *C. calcarata*, posterior to PME; 18, gland indicated by arrow in 17; 19, *C. shastae*, anterior and retrolateral to left eyes; 20, same species, different specimen, posterior to PME. Arrows indicate some of glands present. P=PME.

Chamberlin and Ivie, and an unidentified species of each of *Blabomma* Chamberlin and Ivie, *Calymmaria* Chamberlin and Ivie, and one unidentified genus. Similarly, the clubionid *Phrurotimpus borealis* (Emerton), which shares conspicuous paired ventral tibial macrosetae and habitat type with *Cybaeota*, lacks this type of gland.

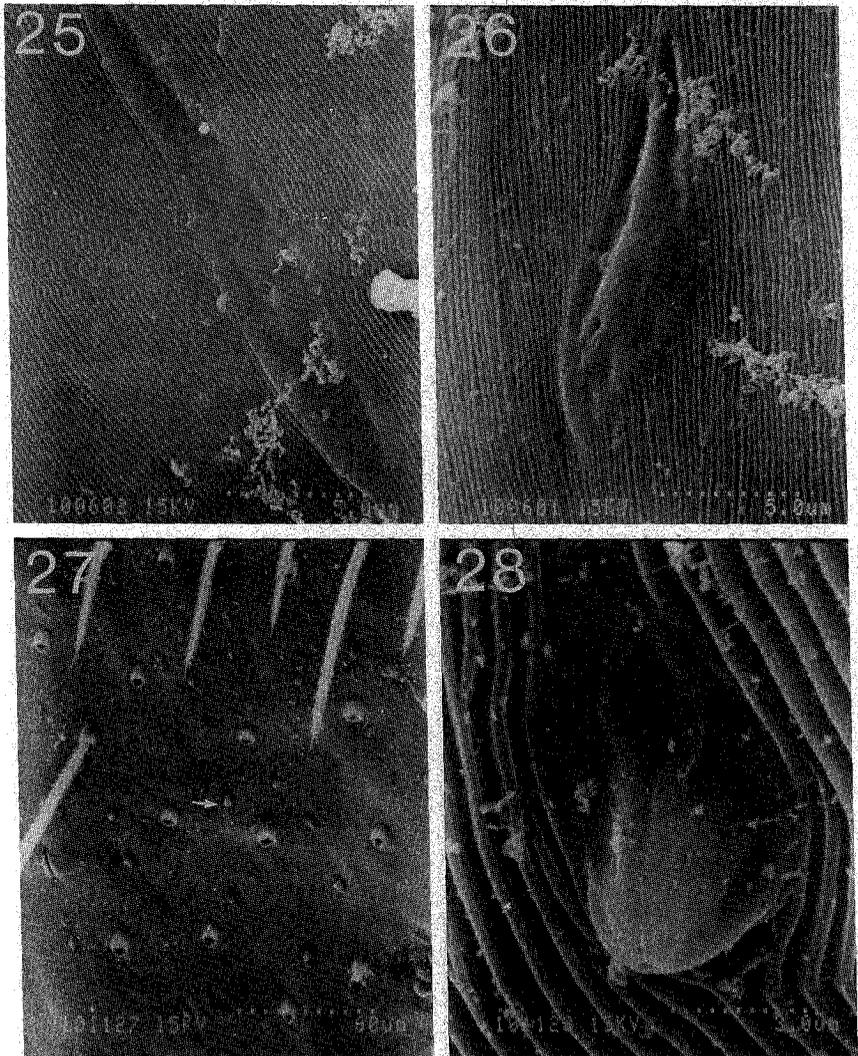
The placement of these glands on *Cybaeota* gives strong circumstantial support to Emerit's (1984) repugnatory secretion hypothesis. Like many other spiders, *Cybaeota* will often "feign death" when disturbed, folding its legs up above the carapace and bending them at the femur/patella joints. In this posture the most exposed regions of an individual are the dorsal surfaces of the tibiae and patellae and to a lesser extent the cephalic region and the ventral lateral parts of the femora. These are the same areas in which the heaviest concentrations of Emerit's



Figures 21-24.—Emerit's gland distribution in *Cybaeota* spp.: 21, 22, *C. nana*; 21, two on proximal retrolateral margin of chelicera; 22, two (indicated by arrows) below left AME; 23, 24, *C. shastae*; mid-dorsally on carapace between eye group and dorsal groove: 23, eight glands (indicated by arrows); 24, gland in Fig. 23 indicated by horizontal arrow. A=AME.

glands occur. Relatively unexposed areas (sternum, dorsal surfaces of coxae and femora, and ventral surfaces of the tibiae) or less "important" segments (tarsi) have no glands.

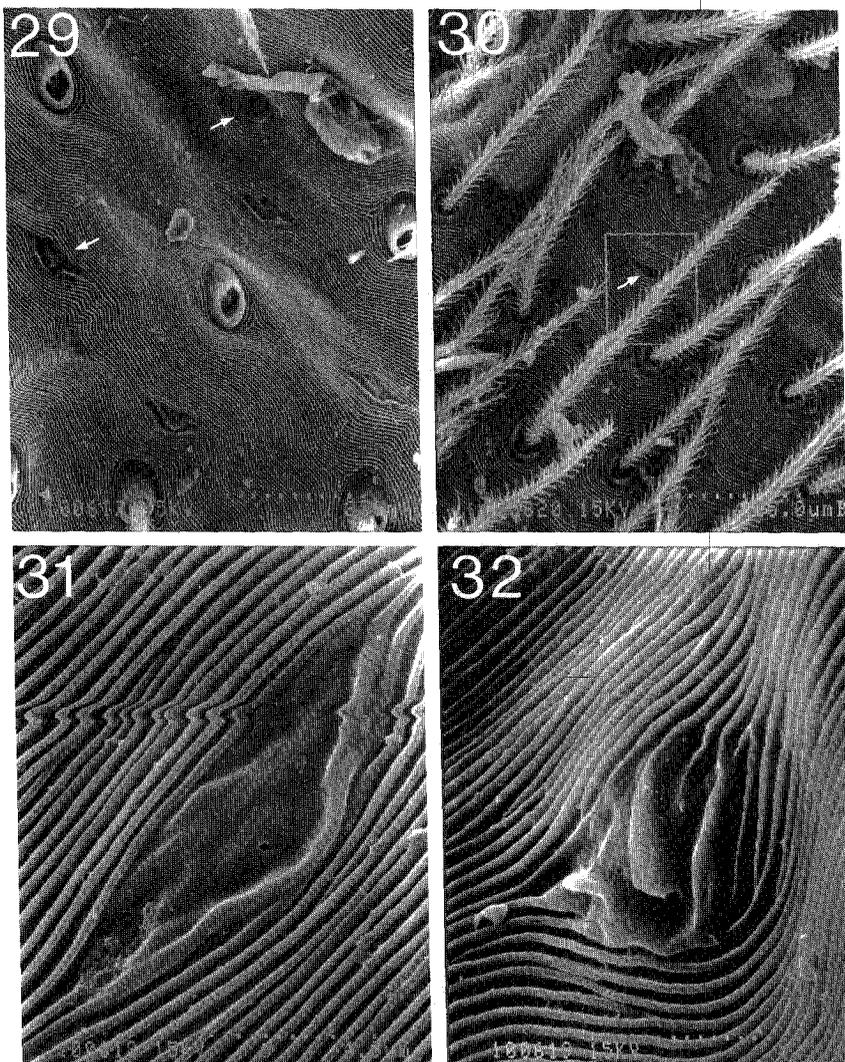
From the above overview it can be concluded that Emerit's glands appear in several distantly related groups of spiders either as a retained plesiomorphy or a frequent convergence. Because of their recently demonstrated wide distribution, it is important to reexamine the status of Emerit's glands as the sole synapomorphy of Leptonetidae plus Telemidae. Marshall (1987) has argued that in the absence of a known outgroup phylogeny the frequent occurrence of a character in the outgroup makes an equivocal polarity decision more probable and increases the likelihood that what is being interpreted as homology is actually homoplasy.



Figures 25-28.—Emerit's gland distribution in *Cybaeota* spp.: 25, 26, *C. nana*, ventrally on coxae; 25, coxa IV; 26, coxa III; 27, 28, *C. calcarata*, dorsally on abdomen; 27, at least 16 glands present; 28, gland indicated by arrow in Fig. 27.

Outgroup relationships at the family level in spiders are uncertain. It is likely that the distribution of Emerit's glands is wider than currently documented (Platnick pers. comm., Wanless pers. comm.). The probabilities of polarity error and misinterpreted homoplasy with respect to Emerit's glands are increased because of this and render this character unreliable as an indicator of monophyly. It is quite possible this character is a true synapomorphy of Leptonetidae plus Telemidae. No synapomorphies are known which contradict this grouping (Platnick 1986). For these reasons Platnick's hypothesis (1986) stands.

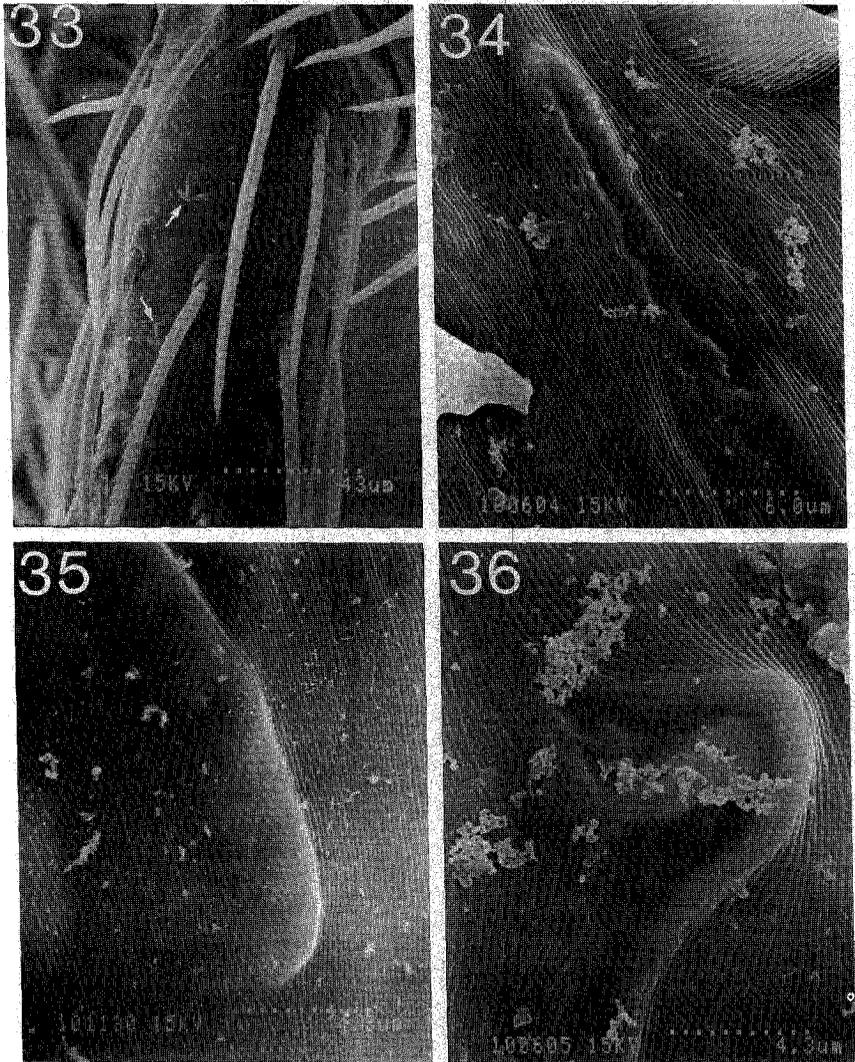
The discovery of Emerit's glands in *Cybaeota* does nothing to resolve its relationship with other spiders. *Cybaeota* remains in the Agelenidae, Cybaeinae but *incertae sedis*.



Figures 29-32.—*Cybaeota nana*, Emerit's glands on abdomen: 29, dorsal, five glands (two indicated by arrows); 30, ventral, one gland, indicated by arrow; 31, dorsal, one gland; 32, same.

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Figures 33-36.—*Cybaeota* spp., Emerit's glands proximodorsally on metatarsi: 33, *C. shastae*, two glands (indicated by arrows), leg IV; 34, *C. nana*, one gland, leg IV; 35, *C. calcarata*, one gland; 36, *C. nana*, one gland proximal to gland in Fig. 34.

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