REVISED DIAGNOSIS OF *EPICRIUS* CANESTRINI AND FANZAGO, 1877 AND DESCRIPTION OF FOUR NEW SPECIES (ACARI: MESOSTIGMATA: EPICRIIDAE)

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ABSTRACT - A revised diagnosis of the genus *Epicrius* Canestrini and Fanzago, 1877 (Acari: Epicriidae), is presented and four new species are described: *Epicrius johnstoni* n. sp. (Navarra, Spain), *E. longisetosus* n. sp. (North Carolina, USA), *E. similaris* n. sp. (Maryland, New York, USA), and *E. undulatus* n. sp. (North Carolina, USA). A key to species based on adult females is given.

Key words - Acari, Mesostigmata, Epicriidae, *Epicrius*, Spain, USA.

INTRODUCTION

The enigmatic lower derivative mesostigmatid family Epicriidae is poorly known. Previous knowledge of the family Epicriidae and *Epicrius* was summarized by Evans (1955), Athias-Henriot (1961), Bregetova (1977), Blaszak and Alberti (1989), Gwiazdowicz (2000) and Moraza and Johnston (2004). In the present paper, four new species of *Epicrius* are described. A new definition for the genus may add information for phylogenetic analysis of the generic relationships within the family.

MATERIAL AND METHODS

The specimens from Spain were collected by the author during soil ecology studies in Navarra, northern Spain (specimens in the Museo de Zoología, Universidad de Navarra, MZUNAV). North America specimens belong to the Division of Insects, Field Museum of Natural History (Chicago, Illinois USA) (FMNH), the Acarology Collection, The Ohio State University (Columbus, Ohio, USA) (OSAL) and the collection of the Museum of Zoology, University of Michigan (UMMZ).

Specimens were examined using light microscopy and were cleared in Nesbitt's solution and mounted in Hoyer's medium. Drawings were made from slide mounted specimens.

Idiosomal setal notation follows Lindquist and Evans (1965), with modifications for the caudal region as given by Lindquist (1994) and Lindquist and Moraza (1999). The system of signs for designating dermal glands and lyrifissures is based on Johnston and Moraza (1991) and

Krantz and Redmond (1987). The system describing setal nomenclature and chaetotactic formula of tarsus I follows the terminology of Evans (1963). All measurements are given in micrometers (µm), presented as ranges (minimum to maximum) or mean, size range, or as approximations (only specimens in good conditions were measured).

Epicrius Canestrini and Fanzago, 1877

Diagnosis (Based on adults of both sexes) - Tectum (Fig. 1) dentate; subcapitulum (Fig. 2) with setae *hyp1* long (twice as long as other subcapitular setae) and barbed; *hyp2* and *hyp3* approximately equal in length and capitular setae slightly longer and barbed; deutosternum with three rows of denticles. Chelicerae (Figs. 15-17) with antiaxial hyaline apophysis; fixed digit with a dentate molar process in antiaxial position between two paraxial teeth, pilus dentilis reduced to an inconspicuous insertion; movable digit with one tooth. Palps (Figs. 4-7) with setation 2-5-6-14-15; palp-tarsus with a dorsal lyrifissure; claw 3-tined. Dorsal shield in females and males extended laterally and ventrally to fuse with peritrematic and exopodal elements (Figs. 10-12, 26-28). Dorsal cuticular ornamentation with bi- or trifurcate tubercles, forming a polygonal network (usually one seta in each reticule). Dorsal chaetotaxy (Figs. 10, 11) with 32 pairs of setae (*j1-j6*, *z4-z6*, *s1-s6*, *r3-r5*, *J2-J5*, *Z2-Z4*, *S3-S5*, *R1-R4*). Podonotum (Fig. 10) with nine pairs of glands: four pairs of simple glands (glands with a single opening) (*gdj4*, *gdj6*, *gds4*, *gds5*), five pairs of glandular complexes (one gland opening and one non-glandular port) (*gdj1*, *gdj3*, *gdz5*, *gds2*, *gds6*) and one pair of "pustules" (two or more glands *gdz6* with two gland openings on a con-

Figs. 1-5. *Epicrius johnstoni* n. sp. (Female, paratype) - 1. tectum; 2. subcapitulum, ventral; 3. tritosternum, ventral; 4. palp, right side, posterolateral; 5. palp, genu, tibia, tarsus, right side, anterolateral. Figs. 6-7. *Epicrius mollis* (Kramer) (Female) - 6. palp, tarsus, dorsal; 7. palp, tarsus, posterolateral.

spicuous protuberance) (Fig. 25). Podonotum with five pairs of lyrifissures; *ids6* and *idz6* associated with the pustule. Opisthonotum (Figs. 10, 11) with four pairs of simple glands (*gdJ2*, *gdJ4*, *gdJ5*, *gdZ2*) and five pairs of lyrifissures (*idJ4*, *idJ5*, *idS4*, *idZ4*, *idR3*). Peritrematal region with simple *gp1* on soft cuticle, glandular complex *gp3* and three pairs of lyrifissures. Tritosternum (Fig. 3) with laciniae trifold, the medial branch thinner and twice as long as the lateral branches. Sternum in adult female (Fig. 11): *st1* on separate jugulars; *st2*, *st3* and *st4* on sternal shield or *st2*, *st3* on sternal shield and *st4* on metasternal shields (only in *E. mollis*); glands *gv1* absent and *iv3* always present. Female genital shield (Figs. 11, 27, 33, 37) broadly expanded behind coxae IV; anterior margin of the epigynial region smooth; *st5* (*g*), *Zv1* and *iv5* on the shield. Females and males with

nine pairs of opisthogastric setae and three pairs of lyrifissures. Females with two pairs of *gv2* double (Fig. 32); *gv2* simple, sometimes incorporated in sternogenital shield in males. Male (Figs. 12, 28, 35, 38) sternogenital shields with four pairs of setae (*st2*, *st3*, *st4* and *st5*), lyrifissures *iv3* and *iv5*. Male genital opening (Fig. 13) with two valves; large anterior valve with one pair of eugenital setae. Female with anal (Fig. 11) or ventrianal shield with one pair of preanal setae (Fig. 14). Males with anal or ventrianal shield, free, or partially, or completely fused to dorsal shield; ventral shield or ventral scutellum present or absent. In both sexes glands *gv3* and cribrum present (Fig. 11); glands *gv4* absent and *ivp* off anal shield. Tarsus I (Fig. 18) with apical pointed projections (vestigial ambulacrum?) present or absent; 48 setae (5 30/8 5), including three macrosetae (*av3*,

Figs. 8-10. *Epicrius johnstoni* n. sp. - 8. Female (paratype), coxa I, right side, ventral; 9. Deutonymph, coxa I, right side, ventral; 10. Female (holotype), idiosoma, dorsal.

al4, *pl4*) or four macrosetae (*av3*, *pv3*, *al4*, *pl4*), with clubbed spiny tip and one anterolateral spinelike seta; a small ventral apophysis between *av2* and *pv2* (Fig. 18). Tarsi II-IV with pretarsi (paired claws and pulvillus); with 18 setae (including apical dorsal setae *ad1*, *pd1* which resemble seta-like processes) and dorsal glands (one telotarsal *gtt* and two basitarsal *gbt* associated with dorsum of circumpodal lyrifissure); dorsal lyrifissure incorporated to circumpodal fissure so that together they circumscribe a dorsal platelet bearing setae *ad3* and *pd3* (Fig. 20). Coxa I (Figs. 8, 9) in adult with four anterolateral glands and seven basal glands; deutonymph with seven anterolateral glands and seven posteroventral glands. In both sexes, setation of trochanters of legs, respectively, 6-5-5-5; that of femora, 13-13-8-8; that of

genu, 2 3/2 3/1 2 (13), 2 3/1 2/1 2 (11), 2 2/1 2/1 2 (10), 2 2/1 3/1 1 (10); that of tibia, 2 3/2 3/2 2 (14), 2 2/1 2/1 2 (10), 2 1/1 2/1 2 (9), 2 1/1 3/1 2 (10). Tibia I (Fig. 39), *av1* macroseta with clubbed, spiculated tip.

***Epicrius johnstoni* n. sp.**
(Figs. 1-5, 8-13, 15-25)

ADULT FEMALE (n = 4) - Idiosomal length 761 (704-791), width 640 (608-652).

Gnathosoma - Chelicerae (Fig. 15-17) and subcapitulum (Fig. 2) as described for the genus, with the antiaxial hyaline apophysis poorly developed. Tectum (Fig. 1) strongly dentate. Palps with the normal setation; palpgenu

Figs. 11-13. *Epicrius johnstoni* n. sp. - 11. Female (holotype), idiosoma, ventral; 12. Male, idiosoma, ventral; 13. Male (paratype), genital shield.

with seta *al2* pectinate (Fig. 5); trochanter with ventral setae pectinate (Fig. 4).

Dorsum (Fig. 10) - Dorsal shield ornate with rounded tubercles; 32 pairs of setae heterogeneous in length, stout and slightly barbed; setae *s2*, *s3*, *gds2* and *ids2* on the same reticule and together with *s1*, *r3*, *r4* and setae *R* are the shortest dorsal setae; $j2 = j3 = z4 = s4 = r5 < j4 = j5 < z5 = s5$; *s6*, *S3*, simple *gds6*, pustular complex *gdz6* (Fig. 25) and both lyrifissures on the same reticule. Dorsal poroidotaxy and adenotaxy as described for the genus. Glands with sclerotized rings. Peritrematal glands *gp1* on soft cuticle.

Venter (Fig. 11) - Tritosternum (Fig. 3) as described for the genus. Jugular shields small and poorly sclerotized. Endopodal shields present, poorly sclerotized. Sternal shield quadrangular in shape bearing *st2*, *st3*, *st4*, and *iv3*; genital shield with genital setae (*st5*), *Zv1* and *iv5*. Glands *gv2* double. Anal shield free; anal valves with vestigial euanal setae and lyrifissures; paranal setae longer than postanal seta. Opisthogaster with nine pairs of setae: *Zv1* on genital shield, *Jv1* and *Jv2* on the soft cuticle and the rest on the ornate and sclerotized shielding.

Legs - Tarsus I (Fig. 18) with apical projections; with three clubbed macrosetae (*pv3* simple). Tibia I with *av1* clubbed, *av2* and *pv2* with spiculated tips. Tarsus I 192 long, tarsus II 202, tarsus III 177, tarsus IV 248; tibia I 227, tibia II

86, tibia III 84, tibia IV 105; genu I 134, genu II 85, genu III 77, genu IV 97. Tarsus II-IV (Figs. 20) with dorsal sclerite bearing dorsal setae "d3", as described for the genus. Coxa I (Fig. 8) with four anterolateral and seven basal glands. Ratio of body length/tibia I = 3.4.

ADULT MALE (n = 6) - Idiosomal length 671 (635-722), width 555 (548-557).

Gnathosoma - Chelicerae, palps and subcapitulum similar to female. Tectum dentate, similar to female.

Dorsum - Dorsal chaetotaxy, adenotaxy and poroidotaxy similar to female; dorsal shield completely fused with peritrematal, exopodal and anal shields (Fig. 12).

Venter (Fig. 12) - Jugular shields small and poorly sclerotized; sternogenital shield reaches the posterior margin of coxae I; genital shield (Fig. 13) with two valves, anterior large and with eugenital setae, posterior valve reduced. Simple glands *gv2* conic in shape. Anal shield completely fused with dorsal shield; setae *Zv1* on pair of large and smooth ventral scutella; other opisthogastric setae on sclerotized ventral shield.

Legs - Similar to the female.

PROTONYPH (n = 3) - Idiosomal length 407 (405-409), width 327 (304-349).

Dorsum (Fig. 21) - Dorsal surface of the protonymph is incompletely covered by weakly sclerotized, slightly or-

Figs. 14. *Epicrius mollis* (Kramer) - Female, ventrianal sclerite. Figs. 15-20. *Epicrius johnstoni* n. sp. (Female, paratype) - 15. chelicera, ventrolateral; 16. chelicera, fixed digit, apical, ventral view; 17. chelicera, movable digit, dorsolateral view; 18. tarsus I, right leg, dorsolateral view; 19. tarsus IV, pretarsus, lateral; 20. tarsus IV, left side, posterolateral.

nate shield bearing 18 pairs of setae heterogeneous in length (*j1-j6*, *z4*, *s4-s6*, *r3*, *r5*, *J2*, *J3*, *Z2*, *Z3*, *S3*); interscutal cuticle with five pairs of dorsal setae (*J4*, *J5*, *Z4*, *S4*, *S5*). Dorsal setae *j4*, *z5*, *s5*, *Z2*, *Z3* and *J5* very long with spiculated tips.

Venter (Fig. 22) - Sternum with three pairs of setae (*st1*, *st2*, *st3*); *st5* basal to posterior border of coxa IV; opisthogaster with four pairs of setae (*Jv1*, *Jv2*, *Jv5* and *Zv2*). Legs with normal chaetotaxy.

DEUTONYMPH (*n* = 2) - Idiosomal length 510 (504-515), width 436 (435-436).

Dorsum (Fig. 23) - Dorsal shield poorly sclerotized, ornate, covers the entire idiosoma. Dorsum with 32 pairs of setae heterogeneous in length with spiculated tips (setae *s1*, *z6*, *s2*, *s3*, *r4*, *R2-R4* added to the protonymphal chaetome). Peritreme as in protonymph.

Venter (Fig. 24) - Sternum with normal setation; nine pairs of opisthogastric setae on soft and poorly sclerotized ventral cuticle (*Jv1-Jv5*, *Zv1-Zv4*). Leg chaetotaxy normal.

Type material - Holotype female, one paratype male: SPAIN, Navarra, Erize-Atez, from litter of *Larix kaempferi*, 24. XI. 1982, M.L. Moraza coll. (deposited in MZUNAV);

Figs. 21-22. *Epicrius johnstoni* n. sp. (Protonymph) - 21. idiosoma, dorsal; 22. idiosoma, ventral.

one paratype male, SPAIN, Navarra, Quinto Real (Preseta), from litter of *Larix kaempferi*, 1.VI.1982, M.L. Moraza coll. (deposited in MZUNAV); two paratype females, four paratype males, one paratype deutonymph and two paratype protonymphs: SPAIN, Navarra, Quinto Real (Preseta), from litter of *Larix kaempferi*, 26.VIII.1982, M.L. Moraza coll. (deposited in MZUNAV); one paratype deutonymph: SPAIN, Navarra, Quinto Real (Preseta), from litter of *Larix kaempferi*, 10.XI.1982, M. L. Moraza coll. (deposited in The Ohio State University Acarology Laboratory, Columbus, Ohio (OSAL)); one paratype female and one paratype protonymph, SPAIN, Navarra, Quinto Real (Erreguerena), from a resultant prairie after a *Fagus sylvatica* forest was cut, 26.VIII.1982, M.L. Moraza coll. (deposited in OSAL).

Etymology - The species name "*johnstoni*" refers to the late Dr. Donald E. Johnston, eminent and esteemed acarologist, The Ohio State University, Columbus, Ohio, USA.

***Epicrius longisetosus* n. sp.**
(Figs. 26-29)

ADULT FEMALE (n = 4) - Idiosomal length 531 (489-373), width 364 (362-366).

Gnathosoma - Chelicerae, palps and subcapitulum as described for the genus. Tectum strongly dentate (Fig. 29).

Dorsum - Dorsal shield ornate, with bi- and trilobate tubercles forming a polygonal network. Dorsal setae long, undulate and finely barbed, except for *s1*, *s2*, *s3*, *r3*, *r4* and *R2* which are short and smooth. Setae *s1* and *s2* are the shortest setae; $s3 < r4 = r5 < R2$; $s3 = j3$. Setae *j1*, *s1* and *s2* in the same reticule; *s3*, *r3* and *r4* in the same reticule; *s6*, *S3*, pustule *gdz6*, *gds6* and two lyrifissures in the same reticule. Dorsal adenotaxy and poroidotaxy as in Fig. 26; glands without sclerotized rings around the opening and simple (except for the pustules).

Venter (Fig. 27) - Sternal shield with smooth and short setae *st2*, *st3*, *st4* and *iv3*. Genital shield with anterior border of epigynal region smooth, anterior region with dentate scales and festooned posterior margin. Gland *gv2* double. Opisthogaster with nine pairs of setae: *Zv1* on genital shield, *Jv1* and *Jv2* on soft cuticle and five pairs on sclerotized shield. Anal shield free.

Legs - Chaetotaxy, adenotaxy and poroidotaxy normal for the genus. Tarsus I with three clubbed macrosetae; tibia I, *av1* clubbed. Tarsus I 134 long; tibia I 98; genu I 80 and femur I 136. Ratio of body length/tibia I = 5.4.

ADULT MALE - (Based on one specimen) Idiosomal length 520, width 366.

Figs. 23-25. *Epicrius johnstoni* n. sp. - 23. Deutonymph, idiosoma, dorsal; 24. Deutonymph, idiosoma, ventral; 25. Adult, pustular complex gland *gdz6*.

Gnathosoma - Chelicerae, palps and subcapitulum similar to female.

Dorsum - Dorsal shield (Fig. 26) completely fused to peritrematic, exopododal and anal shielding. Chaetotaxy, adenotaxy and poroidotaxy normal for the genus and similar to the female.

Venter (Fig. 28) - Jugular shields and *st1* reduced; sternogenital shield free with four pairs of setae (*st2* as long as *st1* and shorter than other sternal setae), *iv3* (between *st2* and *st3*) and *iv5*. Opisthogaster with nine pairs of setae: setae *Zv1* on soft cuticle, other opisthogastric setae on sclerotized and ornate shielding.

Legs - Similar to female.

Type material - Holotype female and two paratypes females: NORTH CAROLINA, Wilkes Co., Blue Ridge Pkwy., Jeffress Pk., from log/leaf litter, 17.X.1981, S. Peck coll., FMHD Coll. (deposited in FMHD); one paratype male: VIRGINIA, Grayson Co.; Whitetop Mt., elev. 4000ft., from log litter, 24.VII.1967, S. Peck & A. Fiske Berlese colls., FMFD Coll. (deposited in

FMHD); one paratype female: NORTH CAROLINA, Macon Co., Highlands, hillside above Lake Ravenal, from litter under pine near station, 28.V.1973, W. Suter coll., FMHD Coll. (deposited in MZUNAV).

Etymology - The species name "*longisetosus*" refers to the length of dorsal setae.

***Epicrius similaris* n. sp.
(Figs. 30-35)**

ADULT FEMALE (n = 4) - Idiosomal length 550, width 458.

Gnathosoma - Chelicerae, palps and subcapitulum (Fig. 30) normal for the genus. Capitular setae thick and barbed. Tectum as depicted in Fig. 31.

Dorsum (Fig. 32) - Dorsal shield ornate with bi- and trilobate tubercles forming a typical polygonal network; dorsal setae relatively long, sinuous and finely barbed, except for setae *s1*, *s2*, *s3* and *R2* which are short. Setae *s1* = *s2* = *s3* < *r4* = *R1* > *R2*; *r3* = *s5*; setae *R3* and *R4* similar to other

Figs. 26-27. *Epicrius longisetosus* n. sp. - 26. Male, idiosoma, dorsal; 27. Female (holotype), idiosoma, ventral.

opisthonotal setae. Setae *jl*, *s1* and *s2* in the same reticule. Dorsal adenotaxy as in Figs. 32 and 34: glands simple without rings; glandular pustule *gdz6*, *gds6*, *s6* and *S3* in the same reticule. Poroidotaxy normal.

Venter (Fig. 33) - Anterior and posterior margins of sternal shield bilobate. Sternal setae *st2*, *st3*, *st4* and *iv3* on shield. Genital shield bearing *st5* (g), *Zv1* and *iv5*. Opisthogaster with nine pairs of setae: only pair *Jv1* on the soft cuticle and seven pairs of setae incorporated in sclerotized shield. Gland *gv2* double. Anal shield free.

Legs - Chaetotaxy, adenotaxy and poroidotaxy normal for the genus. Tarsus I with three clubbed macrosetae. Tibia I with *av1* clubbed.

ADULT MALE (*n* = 6) - Idiosomal length 474 (462-483), width 338 (327-353). Chelicerae, palps and subcapitulum similar to female. Dorsum similar to female (Fig. 34).

Venter (Fig. 35) - Jugular shields reduced, sternogenital shield with four pairs of setae, *iv3* and *iv5*. Genital opening between coxae III. Opisthogastric setae *Jv1* on two

ventral scutellae and seven pairs incorporated in sclerotized shield. Anal shield completely fused with dorsal shields.

Legs - Chaetotaxy, adenotaxy and poroidotaxy normal. Tarsus I and tibia I similar to female. Length of tarsus I 124 (119-129), tibia I 87 (84-91), genu I 76 (73-79) and femur I 138 (133-143). Ratio of body length/tibia I length = 5.4.

Type material - Holotype female and five paratype males: from 71-72 (deposited in FMHD); one paratype female: NEW YORK, Hamilton Co., Speculator, from beech-maple litter, 9.VI.1975, B.M. OConnor coll. (deposited in UMMZ); one paratype male: NEW YORK, Newfield, from base of rotten stump, 16.IV.1978, D.A. Potter coll. (deposited in OSAL); one paratype female: NEW YORK, Essex Co., Whiteface Mt., from hollow log, 28.XI.1975, B.M. OConnor coll. (deposited in UMMZ); one paratype female: MARYLAND, Howard Co., Brown's Bridge, from humus, 25.XI.1960, H. Gulbutt coll. (deposited in OSAL).

Figs. 28-31. *Epicrius longisetosus* n. sp. - 28. Male, idiosoma, ventral; 29. Female, tectum, dorsal. *E. similis* n. sp. - 30. Female, subcapitulum, ventral; 31. Female, tectum.

Etymology - The species name “*similis*” refers to the strong similarity of this species with *E. longisetosus* n. sp.

***Epicrius undulatus* n. sp.**
(Figs. 36-43)

ADULT FEMALE (Based on holotype) - Idiosomal length 540, width 412.

Gnathosoma - Chelicerae, palps and subcapitulum normal for genus; deutosternal groove with three rows of denticles. Capitular setae pectinate. Tectum as pictured in Fig. 42.

Dorsum (Fig. 36) - Dorsal shield ornate with bi- and trilobate tubercles. Dorsal setae stout, sinuous and finely barbed; *s1*, *s2*, *s3*, *r4*, *r5*, *R1*, *R2* and *R4* reduced in length and similar; *r3* = *s5*; *R3* similar to other opisthonotal setae; *s1*, *s2*, *s3* and *r4*, in the same reticule. Dorsal adenotaxy and

poroidotaxy normal, as in Fig. 36. Glands simple without rings. Glandular pustules, *gds6*, *s6*, *S3* and two lyrifissures in the same reticule.

Venter (Fig. 37) - Setae *st1* reduced on small jugulars; *st2*, *st3*, *st4* and *iv3* on sternal shield. Genital shield with anterior border smooth and bearing the usual setae and *iv5*. Glands *gv2* double. Opisthogaster with ten pairs of setae (*Zv5* present): *Jv1* and *Jv2* on soft cuticle and seven pairs of setae incorporated in sclerotized shield. Anal shield free.

Legs - Chaetotaxy, adenotaxy and poroidotaxy normal. Tarsus I (Fig. 40) with three clubbed macrosetae; tibia I (Fig. 39) with *av1* long and clubbed, setae *v2* thick and spiculated; femur II (Fig. 43) with one ventral bladellike seta; coxa, trochanter and basifemur of leg III (Fig. 41) with one bladellike seta. Tarsus I length 130; tibia I length 128, genu I length 87 and femur I length 160. Ratio of body length / tibia I length = 4.2.

Figs. 32-33. *Epicrius similis* n. sp. - 32. Female (paratype), idiosoma, lateral; 33. Female (holotype), idiosoma, ventral.

ADULT MALE (n = 2) - Idiosomal length 534 (532-535), width 406 (397-414). Gnathosoma and dorsum similar to female.

Venter (Fig. 38) - Jugulars well developed and *st1* short, sternogenital shield narrow, not expanded behind coxae IV and free, with four pairs of setae (*st2* short, similar to *st1*), *iv3* and *iv5*. Endopodal shields present: endopodal III large. Glands *gv2* simple. Opisthogaster with nine pairs of setae, *Zv1* on soft cuticle and the rest on sclerotized shield. Anal shield completely fused to dorsal shield.

Legs - Adenoatxy and poroidotaxy similar to female; bladlike setae are not present in male.

Type material - Holotype female: Berlese sample, NORTH CAROLINA, Heintooga Picnic Area, Jackson Co., habitat unknown, 21.V.1961, T. Savage Coll. (deposited in OSAL); and one paratype male: Berlese sample, NORTH CAROLINA, Heintooga Picnic Area, Blue Ridge Parkway, Jackson Co., from litter and bit of wood, 21.V.1961, T. Savage Coll. (deposited in OSAL); one

paratype male: Berlese sample, VIRGINIA, Comers Rock, locality uncertain, from oak litter, 19.V.1961, W. Moss Coll. (deposited in MZUNAV).

Etymology - The specific name "*undulatus*" refers to the curly, corkscrew shape of the dorsal setae.

DISCUSSION

Epicrius, and other genera of the family Epicriidae, have a deficient dorsal chaetome, a condition clearly paedomorphic in *Neoepicrius* Moraza and Johnston, 2004. Evans (1955) described dorsal and ventral chaetotaxy of immature instars of *E. mollis* (Kramer, 1876). In that description, he indicates that only three pairs of "long whiplike setae" are on the soft cuticle posterior to the weakly sclerotized dorsal shield of the larva. However, Lindquist and Evans (1965) observed four pairs of opisthogastric setae on the interscutal cuticle posterior to coxae IV, setae *Jv1*, *Jv2*, *Jv5* and *Zv2*, in the same instar. The missing larval

Figs. 34-35. *Epicrius similis* n. sp. (Male) - 34. idiosoma, dorsal; 35. idiosoma, ventral.

opisthonotal setae apparently belong to the J (*J2-J5*,) and S (*S3-S5*) series. It is clear that the appearance of some or all of these setae are delayed in the protonymphal instar in the epicriids, and other larval and postlarval setae (probably *J1*, *J2*, *Z1*, *S1*, *S2*) may be lost forever.

Coxae I have seven anterolateral glands in the deutonymph and four in the adult (three glands disappear), apparently a usual condition in Mesostigmata (see Fain, 1966, *Dermanyssus*).

The new species described here belong to a group of *Epicrius* with the following female characteristics: setae *st4* on sternal shield, ventral scutellum absent, free anal shield; one or two pairs of opisthogastric setae on soft interscutal cuticle behind genital shield and dorsal setae pilose. The characteristic of the males of this species group is that the anal shield is completely fused with the dorsal and ventral shields. Within this group, the following keys may help in discussing and identifying the species.

Key for adult females of *Epicrius*

1. One pair of interscutal opisthogastric setae; dorsal setae long, extending beyond bases of setae next behind, ex-

- cept for three short pairs (*s1-s3*) on anterior half of dorsal shield; pustule, *s6* and *S3* in same reticule (550 μ m long), USA (Figs. 30-35).....*similars* n. sp.
- Two pairs of opisthogastric interscutal setae2
2. Most dorsal setae short, their tips do not extend beyond bases of posterior setae; pustule and *s6* seta in same reticule, Japan.....
-*nemorosus* Ishikawa and *omogoensis* Ishikawa
- Podonotal and/or opisthonotal setae longer, their tips extending beyond bases of setae next behind; pustule, *gds6*, *s6* and *S3* in the same reticule.....3
3. Podonotal setae short, their tips do not extend beyond bases of setae immediately posterior, except for *j6*, *z6* and *s6*; opisthonotal setae longer, their tips extending beyond bases of next setae; dorsal tubercles round; dorsal glands with sclerotized rings; (694 μ m long), Spain (Figs. 10, 11, 15-18).....
-*johnstoni* n. sp.
- Podonotal setae longer than distance between their bases except for six short setae on anterior half of dorsal shield; dorsal tubercles bi- and trilobated, dorsal glands without rings.....4

Figs. 36 -37. *Epicrius undulatus* n. sp. (Female, holotype) - 36. idiosoma, dorsal; 37. idiosoma, ventral.

4. Dorsal setae at least twice as long as the distance between their bases; setae $s1 < s2 < s3$; $s1 < r4 = r5$ (531 μm long), USA (Figs. 26-29).....*longisetosus* n. sp.
- Dorsal setae as long as or slightly longer than distance between their bases; $s1 = r4 = r5$ (540 μm long), USA (Figs. 36-43)..... *undulatus* n. sp.

Key for adult males

1. A pair of ventral scutella with one pair of setae, without opisthogastric interscutal setae.....2
- Ventral scutella absent and one pair of opisthogastric interscutal setae.....3
2. Dorsal glands with rings; more than five pairs of podonotal setae do not extend beyond bases of consecutive setae; sternogenital shield reaches posterior border of coxae IV (671 μm long) (Figs. 12, 13).....*johnstoni* n. sp.
- Dorsal glands without rings; five pairs of podonotal setae do not extend beyond bases of consecutive setae; sternogenital shield extends behind posterior border of coxae IV (474 μm long) (Figs. 34, 35).....*similaris* n. sp.
3. Most dorsal setae long, at least twice as long as distance between their bases; five pairs of short podonotal setae (520 μm long) (Fig. 28).....*longisetosus* n. sp.
- Dorsal setae shorter; five or more pairs of short podonotal setae on anterolateral position.....4
4. Nine pairs of short podonotal setae on anterolateral position ($j1$ and $j2$ not included); sternogenital shield posteriorly expanded (640 μm long).....*buresschi* Balogh
- Five pairs of short podonotal setae on anterolateral position.....5
5. Pustule, $s6$ and $S3$ in same reticule; setae $j2 < j2 - j3$; dorsal setae wavy, corkscrew shaped; sternogenital shield narrow (ratio length/width ≥ 3), not extending behind coxae IV, with parallel lateral margins (534 μm long) (Fig. 38).....*undulatus* n. sp.
- Pustule and $s6$ in the same reticule; setae $j2 \leq j2 - j3$; dorsal setae not wavy; sternogenital shield wide (ratio length/width < 3) (510 μm long).....*bulgaricus* Balogh

The genus *Epicrius* is well represented in the Holarctic Region. In Europe, it has been reported from Bulgaria (Balogh, 1958), Spain (Athias-Henriot, 1961), Austria, Eng-

Figs. 38 - 43. *Epicrius undulatus* n. sp. - 38. Male, idiosoma, ventral; 39. Female, tibia I, right leg, ventral view; 40. Female, tarsus I, right leg, anterolateral view; 41. Female, leg III, coxa, trochanter, femur, right leg, ventral view; 42. Female, tectum, dorsal; 43. Female, femur II, right leg, anterolateral view (all, except male, holotype).

land, France, Germany, Israel, Italy, Netherlands, Romania, Russia, Sweden, Switzerland, (Evans, 1955; Bregetova, 1977; Iavorschi, 1995, Gwiazdowicz, 2000); in Asia, from Japan (Ishikawa, 1987), Nepal (Hyatt, 1956), from North Africa (Athias-Henriot, 1961) and *Epicrius washingtonianus* Berlese, 1916 reported from North America.

ACKNOWLEDGEMENTS

Special thanks to the late Dr. J. B. Kethley, of the Division of Insects, Field Museum, Chicago, USA, and to Dr. B. M. O'Connor, Museum of Zoology, University of Michigan, for important material of *E. longisetosus* and *E. similis*. This work has been supported by the Departamento de Educación, Universidades e Investigación, Gobierno Vasco (Spain), and The Ohio State University, Columbus, Ohio (USA).

This study of Epicriidae is dedicated, with respect and admiration, to my teacher, colleague and dear friend, the late Dr. Donald E. Johnston. He was the catalyst and active man-

ager of this work and provided the inspiration and strength to draft the original manuscript.

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