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**THREE NEW SPECIES OF NEOQUERNASPIS
(HOMOPTERA : COCCOIDEA : DIASPIDIDAE) FROM NEPAL**

By TONG-XIAN LIU and H.H. TIPPINS
with additional notes by S. TAKAGI

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Abstract

LIU, T.-X. and TIPPINS, H.H. 1988. Three new species of *Neoquernaspis* (Homoptera : Coccoidea : Diaspididae) from Nepal [with additional notes by S. TAKAGI]. *Ins. matsum. n. s.* 39: 35-48, 4 figs. (4 pls.).

Three new species of *Neoquernaspis* from Nepal are described and illustrated. They are: *N. takagii* Liu and Tippins, from *Castanopsis tribuloides*, *N. howelli* Liu and Tippins, from *Quercus glauca* and *N. beshearae* Liu and Tippins, from *Lithocarpus pachyphylla*. A key to the adult females of the known species in this genus is presented. In addition, a drawing of the second instar male of *N. beshearae* is given, and four other species are mentioned as possible members of *Neoquernaspis*.

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Contents. *Neoquernaspis takagii*, n. sp. — *Neoquernaspis howelli*, n. sp. — *Neoquernaspis beshearae*, n. sp. — Key to adult females — Additional notes.

INTRODUCTION

The genus *Neoquernaspis* was erected by Howell and Takagi (1981) to include 3 East Asian species: *N. nepalensis* (Takagi), *N. chiulungensis* (Takagi) and *N. lithocarpis* (Takahashi) which were previously included in the North American genus *Quernaspis* named by Ferris (1937) (Takagi and Howell, 1977). Howell and Takagi (1981) listed 3 important morphological characters distinguishing the new genus from *Quernaspis*: 1) dorsal marginal macroducts on abdominal segment VII with thickened rims and their surrounding scleroses only slightly asymmetrical; 2) median lobes flanked by stout sclerotized pore prominence; and 3) marginal macroducts on ventral surface same size as those on dorsal surface. In *Quernaspis*, the surrounding scleroses of dorsal marginal macroducts on abdominal segment VII are distinctly asymmetrical; pore prominence flanking median lobes is weak or lacking, and marginal macroducts on the dorsal surface tend to be smaller than those of the venter.

Species in both *Quernaspis* and *Neoquernaspis* probably originated in Southeast Asia in association with host plants of the family Fagaceae. Later dispersal to North America resulted in a distinct new world subgroup of the genus *Quernaspis* which contains 3 described species at present: *Q. quercus* (Comstock), *Q. quercicola* Tippins and Beshear, and *Q. insularis* Howell.

The following descriptions and illustrations are of 1/2 the dorsal surface and ventral surface, and should be doubled for an entire view of the body of both surfaces. Measurements are given in microns. The measurements or ranges given include both the holotype and all the paratypes.

We have used a standard system of labeling figures. Thus the following labeling applies to all figures:

A-test of adult female; B-lateral view of adult female test; C-body of adult female; D-pygidium; E-median lobes, dorsal surface; F-median lobes, ventral surface; G & H-macroducts; I-seta; J-antenna; K-anterior spiracle; L-gland spine; M-gland tubercles; N-microduct.

Neoquernaspis takagii Liu and Tippins, n. sp.

(Fig. 1)

Test of Adult Female (Fig. 1A): Very elongate; exuviae terminal, yellowish brown or dark brown, the end of second exuviae yellow; first instar exuviae small, 268-366 long; first and second instar exuviae combined with a length of 488-610, occupying about one third to one fourth of total body length; secretion behind exuviae white or grayish white; fully developed test 1100-1178 long, and 293-415 wide, convex dorsally (Fig. 1B), curved to left or right or straight. Both males and females feed on underside of leaves.

Body of Adult Female (Fig. 1C): Elongate, broadened posteriorly and moderately lobed laterally; slide mounted, 586-833 long and 257-288 wide at abdominal segment I; derm membranous except for a sclerotized pygidium.

Pygidium (Fig. 1D): Very small compared with the elongate body. Median lobes (Figs. 1E & F) well developed, fused basally and then widely divergent; each lobe pointed apically with a short and smooth mesal margin and a long, lateral

margin with 4-5 distinct tooth-like serrations. Second and third pairs of lobes reduced, both lobules represented by 3-5 tooth-like serrations. Gland spines, setae and macroducts present.

Dorsal Surface

Macroducts (Figs. G & H): Two-barred, 6.7-9.4 long and 5.4-8.0 wide at orifice ; 1 marginal on abdominal segment VII between median and second pair of lobes, with a sclerotized rim around orifice ; usually 3 on abdominal segment VI (2 marginal, 1 submarginal) ; 3-4 on abdominal segment V (1-2 marginal, 1-2 submarginal and 1 submedian) ; 1-2 on abdominal segment IV (1 marginal, 1 or absent on submedian) ; 3-5 small macroducts on abdominal segment III (2-3 scattered on margin-submargin, 1-2 submedian) ; 2-5 small macroducts on each margin-submargin area of abdominal segments I and II ; 2-4 on metathorax ; rarely 1 on mesothorax.

Setae (Fig. 1I): 3-5 small setae on cephalic region, 1 on each margin of thoracic segments and abdominal segments I-VII, 1 at base of median lobe, 1 anterior of median lobe ; those on margins of abdominal segment V-VII and at base of median lobe much larger than others ; usually 1 on each submedian area of abdominal segments I-VII.

Anal Area: Anal opening oval or circular, 6.7-12.1 in diameter, located near base of pygidium ; distance from anterior margin of anus to mid-point of line between abdominal segments V and VI, 9.4-16.8 ; distance from posterior margin of anus to end of median lobes, 96-110.

Ventral Surface

Antennae (Fig. 1J): Small tubercles, 2.7-4.0 long and 3.3-5.4 wide at base ; each with a long, slender fleshy seta, 13.4-16.1 long, and with 2 tiny sensory setae on top of antenna. Distance between two antennal bases, 40.2-67.0.

Spiracles : Elongate, anterior spiracle (Fig. 1K), 16.1-21.4 long, atrium 5.4-8.0 in diameter, with 1, rarely 2, associated trilocular pores situated anteriolaterally ; posterior spiracle similar in shape to anterior spiracle, 17.4-21.4 long, without associated trilocular pores.

Gland Spines (Fig. 1L): Marginal, 9.4-26.8 long and 4.0-5.4 wide at base, each with an associated microduct ; 1 on each margin of abdominal segments IV-VII and laterad of median lobes.

Gland Tubercles (Fig. M): Submarginal, 8.0-11.7 long and 5.4-6.7 wide at base ; basally conical and distally spine-like, each with an associated microduct ; usually 1-2 on abdominal segment III, 1-3 on II, 1-4 on I, 1-2 or absent on metathorax and sometimes 1-2 on mesothorax ; absent on prothorax.

Setae : Very small, hair-like ; 3-6 on cephalic region, 1 on margins of each thoracic segment and abdominal segments I-VII, base of median lobe, anterior of median lobe ; 2 anterior of vulvar opening ; and usually 1 on each submarginal and submedian area of abdominal segments I-VII.

Macroducts : Marginal-submarginal, small ; 1-2 on abdominal segment III, 2-4 on II, 2-5 on each of I and metathorax, absent on mesothorax and prothorax.

Microducts (Fig. 1N): One-barred, 4.0-6.7 long and 1.8-2.2 wide at orifice ; 4-7 scattered on cephalic region, 3-5 on each of thoracic segments ; 2-4 on each of abdominal segments I-V, and 1-3 on pygidium.

Vulvar Area: Vulvar opening slit-like, situated about middle of pygidium; perivulvar pores quinquelocular, arranged in 5 groups: median, 1-4; anteriolateral, 3-7; posteriolateral, 4-6. In median group, 1 or 2 pores often apart from others, giving an appearance of 2 groups.

Material Studied:

Holotype: On *Castanopsis tribuloides*; adult female on one slide, Phidim, alt. about 1700 m, Mechi, Nepal; Nov. 11, 1983; coll. S. Takagi (material 83 NPL-167a); deposited in United States National Museum of Natural History (USNMNH).

Paratypes: 4 specimens on 4 slides, data same as holotype, deposited one in each of the collections listed below. Five specimens on 5 slides, same host as above; Siwapuri, alt. about 1620 m, near Kathmandu, Bagmati, Nepal; Oct. 19 1983; coll. S. Takagi (material 83 NPL-70). Two of these specimens are deposited in the Georgia Experiment Station Collection (GESC); and one in each of the following: Entomological Institute, Hokkaido University, Japan (EIHU); Entomology Division, Agriculture Department, Khumaltar, Lalitpur, Nepal (EDADKL); Entomological Collection, Agricultural University of Shandong, Taian, Shandong, China (ECAUS) and the dry material is deposited in EIHU.

Remarks: This species is distinguished from others in the genus in having a very elongated body, very few macroducts, perivulvar pores and associated trilocular pores anteriolateral of anterior spiracles.

Etymology: This new species is named in honor of Dr. Sadao Takagi, Entomological Institute, Hokkaido University, Japan, for his excellent contributions to our knowledge of diaspidids of the world, and for his providing all the material for this study.

Neoquernaspis howelli Liu and Tippins, n. sp.

(Fig. 2)

Test of Adult Female (Fig. 2A): Oystershell-shaped; 1590-1950 long and 980-1120 wide; flat (Fig. 2B); exuviae terminal, pale or pale brown; first instar exuviae small, 290-420 long; first and second exuviae together about 610-930 long, occupying about one half to one third of total body length; secretion behind exuviae white or dirty white, firm texture; both females and males on underside of leaves.

Body of Adult Female (Fig. 2C): Elongate, spindle-shaped; 575-954 long and 345-450 wide; widened posteriorly at abdomen, slightly lobed laterally; broadest at abdominal segment I or II; derm membranous except for a sclerotized pygidium; with or without tiny spine-like processes on venter of thorax.

Pygidium (Fig. D): Triangular, quite large. Median lobes well developed (Figs. E & F), fused basally; mesal margin short and parallel about half of its length, then divergent widely with a pointed apex; lateral margin long, with 4-6 tooth-like serrations; base of median lobes heavily sclerotized. Second and third pairs of lobes reduced, each lobule represented by 3-5 well sclerotized tooth-like serrations. Gland spines, macroducts and setae present.

Dorsal Surface

Macroducts (Fig. 2G & H): Two-barred, 3.3-16.1 long and 4.0-9.4 wide, becoming smaller anteriorly; 1 marginal on abdominal segment VII with a thickened rim around orifice; 5-7 on abdominal segment VI (2 marginal, 1-2 submarginal and 1-2 submedian); 7-10 on abdominal segment V (2 marginal, 2-5 submarginal and 3-5 submedian); 7-11 on abdominal segment IV (1-2 marginal, 2-4 submarginal and 3-6 submedian); 6-12 on abdominal segment III (1-2 marginal, 1-5 submarginal, 2-6 submedian); 4-8 on abdominal segment II (3-5 marginal-submarginal, and 1-3 submedian or absent); 2-5 on each marginal-submarginal area of abdominal segment I and metathorax and mesothorax; absent on prothorax.

Microducts: One-barred, usually absent, occasionally few on cephalic region, thoracic segments and abdominal segments I-III.

Setae (Fig. 2I): Very small, 2.5-6.0 long, 3-5 on cephalic region, 1 on margin of thoracic segments and abdominal segments I-VII, 1 at base of median lobes, 1 in front of median lobe; and usually 1 on submedian area of abdominal segments I-VI or VII. The ones on margins of abdominal segments V-VII and laterad of median lobe much larger than others.

Anal Area: Anal opening rounded or oval, 9.4-13.4 in diameter, situated near base of pygidium; distance from anterior margin of anus to midpoint of line between abdominal segments V and VI, 24.1-33.5; distance from posterior margin of anus to end of median lobes, 112-134.

Ventral Surface

Antennae (Fig. 2J): Small tubercles, 6.7-11.2 long and 6.0-10.7 wide at base; each with a long fleshy seta, 13.4-21.4 long, and with 2 tiny sensory setae located in a pit on top of antenna. Distance between 2 antennal bases, 50.9-61.0.

Spiracles: Anterior spiracle (Fig. 2K), 18.8-26.8 long, atrium 6.7-8.0 in diameter; each spiracle with 2-4 (or rarely 1) associated trilocular pore, anteriolaterally located; posterior spiracles same shape and size as anterior ones but without associated trilocular pores.

Gland Spines (Fig. 2L): Marginal, elongate; 3.4-14.7 long and 2.5-4.0 wide at base; usually only 1 on each of abdominal segments IV-VII and laterad of median lobe, each with an associated microduct.

Gland Tubercles (Fig. 2M): Submarginal; basally conical and distally spine-like; 5.0-14.1 long and 4.0-5.4 wide at base; usually 2-4 on each of abdominal segments III and II; 4-7 on I; 3-5 on metathorax; and 1-2 or absent on mesothorax; lacking on prothorax.

Setae: Same size as those on dorsal surface; 4-6 on cephalic region, 1 on margin of each thoracic segment and abdominal segments I-VII; 2 at base of median lobe; 2 anterior of vulvar opening; 1 on submarginal area of each of abdominal segments I-VII; and usually 1 on each submedian area of abdominal segments I-V; and 1-2 on pygidium.

Macroducts: Same shape and size as those on marginal-submarginal areas of abdominal segments I-III and thorax of dorsal surface; 0-1 on abdominal segment III; 1-5 on II; 2-6 on I; 2-5 on metathorax; 1-4 on mesothorax and usually lacking on prothorax.

Microducts : Same size as those on dorsal surface ; usually 4-6 on cephalic region, 3-5 on thoracic segments ; 2-3 on each of abdominal segments I-V ; and 1-3 on pygidium.

Vulvar Area : Vulvar opening slit-like, perivulvar pores quinquelocular, arranged in 5 groups : median, 4-8 ; anteriolateral, 7-14 ; posteriolateral, 7-15 ; each pore 2.7-4.0 in diameter.

Material Studied :

Holotype : On *Quercus glauca* ; adult female on one slide, Swayambhu, alt. about 1300 m, near Kathmandu, Bagmati, Nepal ; Oct. 28, 1983 ; coll. S. Takagi (material 83 NPL-123) ; deposited in USNMNH.

Paratypes : Ten specimens on ten slides, all collected from *Quercus glauca*, same data as holotype ; 2 specimens are deposited in each of USNMNH, EIHU, ECAUS, GESC. Twenty-seven specimens on 27 slides, Swayambhu, Oct. 7, 1983, coll. S. Takagi (material 83 NPL-3) ; 2 specimens are deposited in each of USNM, EIHU, ECAUS, EDADKL, and the rest in GESC. 4 specimens on 4 slides, Sundarijal, alt. about 1560 m, near Kathmandu, Bagmati, Nepal ; Oct. 21, 1983 ; coll. S. Takagi (material 83 NPL-84) ; 2 specimens are deposited in each of GESC and EIHU ; dry material deposited in EIHU.

Remarks : Adult females were collected from two localities : Swayambhu (83 NPL-3 and 83 NPL-84) and Sundarijal (83 NPL-123). The specimens from 83 NPL-3 and 83 NPL-123 are exactly the same in morphology of adult females and first instar nymphs, while the specimens from 83 NPL-84 show slight differences in having tiny spine-like processes on ventral surface of thorax, and apparently having fewer perivulvar pores and macroducts.

This species differs from *N. chiulungensis* in having more perivulvar pores, the total number in the 5 groups ranges from 41-60 (mean=48.5) in this species (19-25, mean=21.9 in *N. chiulungensis* ; from Howell and Takagi, 1977) ; gland spines laterad of median lobes much elongate, the length extending much beyond median lobes ; while in *N. chiulungensis* about same as the length of median lobes or slightly longer ; apparently more trilocular pores anteriolaterad of anterior spiracles (at least one side 2 or more). The differences between these two species are distinct in first instar nymphs (description not available at present).

Etymology : This species is named in honor of Dr. James O. Howell of our Department for his contribution to the knowledge of this group and other taxa of diaspidids, and for his help in various ways during this study.

Neoquernaspis beshearae Liu and Tippins, n. sp.

(Fig. 3)

Test of Adult Female (Fig. 3A) : Large, oystershell-shaped ; 1710-3420 long and 1050-1220 wide ; exuviae terminal, pale brown to yellowish brown ; first instar exuviae 370-730 long ; first and second exuviae together 980-1220 long, about one-half to one-third of total body length ; secretion white or grayish white ; strongly convex dorsally in the middle of test (Fig. 3B), behind exuviae. Test of adult females attached on bark of host plant, while males clustered on underside of leaves.

Body of Adult Female (Fig. 3C): Elongate, spindle-shaped; on slide, 986-1550 long and 652-811 wide; posterior widened and slightly lobed laterally; broadest at abdominal segment I or rarely at II; derm membranous except for a slightly sclerotized pygidium.

Pygidium (Fig. 3D): Large and broad, semicircular or triangular. Median lobes well developed (Figs. 3E & F), short and wide, fused basally; mesal margins short, straight and parallel; lateral margin curved and smooth, not serrated and notched; second and third pairs of lobes reduced, each lobule suggested by 3-5 tooth-like marginal serrations. Gland spines, macroducts and setae present.

Dorsal Surface

Macroducts (Figs. 3G & H): Two-barred, robust; 4.0-9.4 long and 3.3-9.4 wide, getting smaller anteriorly; 2-3 marginal on abdominal segment VII, laterad of median lobes; 9-19 on abdominal segment VI (7-13 marginal-submarginal, 2-6 submedian); 17-25 on abdominal segment V (11-22 marginal-submarginal, 6-13 submedian); 26-39 on abdominal segment IV (15-23 marginal-submarginal, 11-16 submedian); 23-42 on abdominal segment III (14-24 marginal-submarginal, 9-18 submedian); 18-32 on abdominal segment II (10-18 marginal, 8-14 submedian); 14-22 on abdominal segment I (10-14 marginal-submarginal, 4-8 submedian); 11-18 on each of marginal-submarginal area of metathorax and mesothorax, respectively; usually absent on prothorax, rarely 1-3 present.

Microducts: Similar to those on ventral surface (Fig. 3N); sometimes 3-5 on cephalic region, 1-3 on each thoracic segment, and occasionally 1-2 present on some abdominal segments.

Setae (Fig. 3I): Very small, hair-like, 2.8-5.6 long; 3-6 scattered on cephalic region; 1 at margin of each thoracic segment and abdominal segments I-VII, 1 on base of median lobes, 1 in front of median lobe. The ones on margins of abdominal segments V-VII and base of median lobes much larger than others, 12.1-14.7 long.

Anal Area: Anal opening oval or circular, 13.4-18.8 in diameter, located at basal part of pygidium; distance from anterior margin of anus to midpoint of line between abdominal segments V and VII, 32.2-40.2; distance from posterior margin of anus to end of median lobes, 222-255.

Ventral Surface

Antennae (Fig. 3J): Small tubercles, 13.4-18.8 long and 13.4-18.8 wide at base; with 3 finger-like processes, one of these much longer than other two; 2 long and slender setae located in middle of finger-like processes; distance between 2 antennal bases, 80.4-93.8. The shape of antennae in this species is characteristically different from other species.

Spiracles: Anterior spiracle (Fig. 3K), 33.5-37.5 long, atrium 13.4-16.1 in diameter; 20-33 associated trilocular pores, located anteriolaterally; posterior spiracle same shape and size as anterior one, with 6-12 associated trilocular pores. The trilocular pores are small and close to each other, therefore it is hard to count the number exactly.

Gland Spines (Fig. 3L): Marginal, 13.4-23.1 long and 2.7-4.0 wide at base, arranged on abdominal segments IV-VII and laterad of median lobes; usually 2 laterad of median lobes; 2-3 on abdominal segment VII; 1-2 on VI; 1-3 on V; and

2-4 on IV.

Gland Tubercles (Fig. 3M): Basally conical and distally spine-like, 10.8-20.1 long and 5.4-9.4 wide at base, clustered on submarginal areas of abdominal segments I-III and thorax; usually 3-7 on abdominal segment III; 2-7 on II and 15-22 on I; 10-17 on metathorax and 4-9 on mesothorax; very rarely 1 on prothorax.

Setae: Same size as those on dorsal surface; 3-5 on cephalic region; 1 on each margin of thoracic segments and abdominal segments I-VII, 2 at base of median lobe; 2 anterior of vulvar opening, and 1 on each submarginal area of abdominal segments I-VII, and usually 1 on each submedian area of abdominal segments I-V, and 2-3 on pygidium.

Macroducts: Same size as those on marginal-submarginal areas of thoracic segments and abdominal segments I-III of dorsal surface; usually 3-6 on abdominal segment III; 10-18 on II; 12-17 on I; 10-17 on metathorax, 9-14 on mesothorax; and rarely 1-3 on prothorax.

Microducts (Fig. 3N): Same shape and size as those on dorsal surface; usually 5-8 on cephalic region, 4-10 on prothorax; 3-8 on each of mesothorax and metathorax; 2-4 on each of abdominal segments I-V; 4-6 on pygidium.

Vulvar Area: Vulvar opening slit-like; perivulvar pores quinquelocular, arranged in 5 large groups: median, 30-46; anteriolateral, 19-34; posteriolateral, 38-57. More numerous perivulvar pores is one of the most important characters of this species.

Material Studied:

Holotype: On *Lithocarpus pachyphylla*: Adult female on one slide, Sukhe Pokhri, alt. about 2640 m, Mahabharat Range, Mechi, Nepal; Nov. 11, 1983; coll. S. Takagi (Material 83 NPL-157); deposited in USNMNH.

Paratypes: 4 on 4 slides, same data as holotype. One specimen is deposited in each of GESC, EIHU, ECAUS, and EDADKL. Dry material is deposited in EIHU.

Remarks: The most important morphological characters of this species useful in distinguishing it from other species in this genus include: 1) more associated trilocular pores anteriolateral of both anterior and posterior spiracles than in other species, 2) more perivulvar pores, macroducts, gland spines and gland tubercles than in other species, and 3) antennae with 3 thick finger-like processes.

Etymology: This species is named in honor of Miss Ramona Beshear in our Department for technical assistance during this study and for her contributions to our knowledge of scale insects.

Key to Adult Females of Known Species of *Neoquernaspis*

1. One to 3 dorsal macroducts on abdominal segment VII; derm of whole body with tiny spine-like processes *N. nepalensis* (Takagi)
- No dorsal macroducts on abdominal segment VII; derm of body partially with tiny spine-like processes or without those processes.....2
2. More than 20 associated trilocular pores anterolaterad of anterior spiracles, several of these pores anterolaterad of posterior spiracles; more than 29 perivulvar pores in posteriolateral group and median group; median lobes broad and without serrations or notches on lateral margins *N. beshearae*, n. sp.

- Less than 10 associated trilocular pores anteriolaterad of anterior spiracle, and absent near posterior spiracles; less than 20 perivulvar pores in each group; median lobes with or without lateral serrations on lateral margins3
- 3. Median lobes entirely fused; no serrations or notches on lateral margins*N. lithocarpi* (Takahashi)
- Median lobes only basally fused and separated apically; 3-5 serrations on lateral margins4
- 4. Body spindle-shaped, not very elongate; total of perivulvar pores more than 43; gland spines laterad of median lobes much longer than median lobes; on *Quercus**N. howelli*, n. sp.
- Body extremely elongate; total of perivulvar pores less than 25; gland spines about the same length as or slightly longer than median lobes; on *Castanopsis*5
- 5. Only 1 dorsal submedian macroduct on each of abdominal segments IV and V, absent on VI; small macroducts absent on submedian area of each of abdominal segments I and II; median lobes prominent*N. takagi*, n. sp.
- Two or more dorsal submedian macroducts on each of abdominal segments IV and V, 1 on VI; at least 1 small macroduct on submedian area of each of abdominal segments I and II; median lobes not prominent*N. chiulungensis* (Takagi)

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REFERENCES CITED

- Ferris, G.F. 1937. Atlas of the scale insects of North America 1. Stanford Univ. Press. Serial Nos. S1-S136.
- Howell, J.O. and S. Takagi, 1981. *Neoquernaspis*: New genus of armored scales from East Asia. Ann. Entomol. Soc. Amer. 74: 487-488.
- Takagi, S. and J.O. Howell, 1977. The genus *Quernaspis*, a possible Asio-American element in scale insect biogeography (Homoptera: Coccoidea). Insecta Matsumurana n. s. 11: 31-59.
- Takahashi, R. 1931. Descriptions of some new Formosan Coccidae (Rhynchota). Bull. Entomol. Res. 22: 211-220.
- Tippins, H.H. and R.J. Beshear. 1970. A new species of *Quernaspis* (Homoptera: Diaspididae). Ann. Entomol. Soc. Amer. 63: 808-809.

Additional Notes

By S. TAKAGI

Some years ago I submitted some material of *Neoquernaspis*, which I collected

in Nepal in 1983, to Prof. J.O. Howell for his study because he had been advancing the knowledge of the genus. Since that time, however, he has been occupied with other work and the material was studied by Mr Liu and Prof. Tippins.

I. As a consequence three new species are described in the foregoing lines. Another species, collected at some localities on the branches of *Castanopsis indica* and *C. tribuloides*, was included in the material submitted. Mr Liu and Prof. Tippins have refrained from describing it, because it is very close to *Neoquernaspis nepalensis*, appearing to differ only by the median lobes being notched laterally.

II. They also examined immature stages, but did not include them in the present work. A drawing of the second instar male of *Neoquernaspis beshearae*, being readily available, is added here. It will show the presence of much different forms of the second instar male in the genus (compare the drawing [Fig. 4] with the second instar males of *N. nepalensis* and *N. chiulungensis*, Takagi and Howell 1977, Figs. 9 and 12). It seems that the occurrence of such a remarkable polymorphism in the second instar male among congeners is not rare nor exceptional in part of the Diaspidini.

III. In addition to the six species given in the key prepared by Mr Liu and Prof. Tippins the following four may be referable to the genus.

Quernaspis tengjiensis Hu, 1984, Contributions from Shanghai Institute of Entomology 4 : 215 [Yunnan, China, on leaves of an undetermined shrub].

Neoquernaspis unciformis Jiang and Chen, 1984, Entomotaxonomia 6 : 237 [Yunnan, China, on the leaves of an undetermined species of Fagaceae; occurring on the margin of the tip].

Pseudochionaspis quercus Hu, 1986, Contributions from Shanghai Institute of Entomology 5 [1985] : 263 [Yunnan, China, on the leaves of *Quercus* sp.].

Pseudochionaspis hainanensis Hu, 1986, ditto : 265 [Hainan Is., China, on the leaves of a plant of Fagaceae].

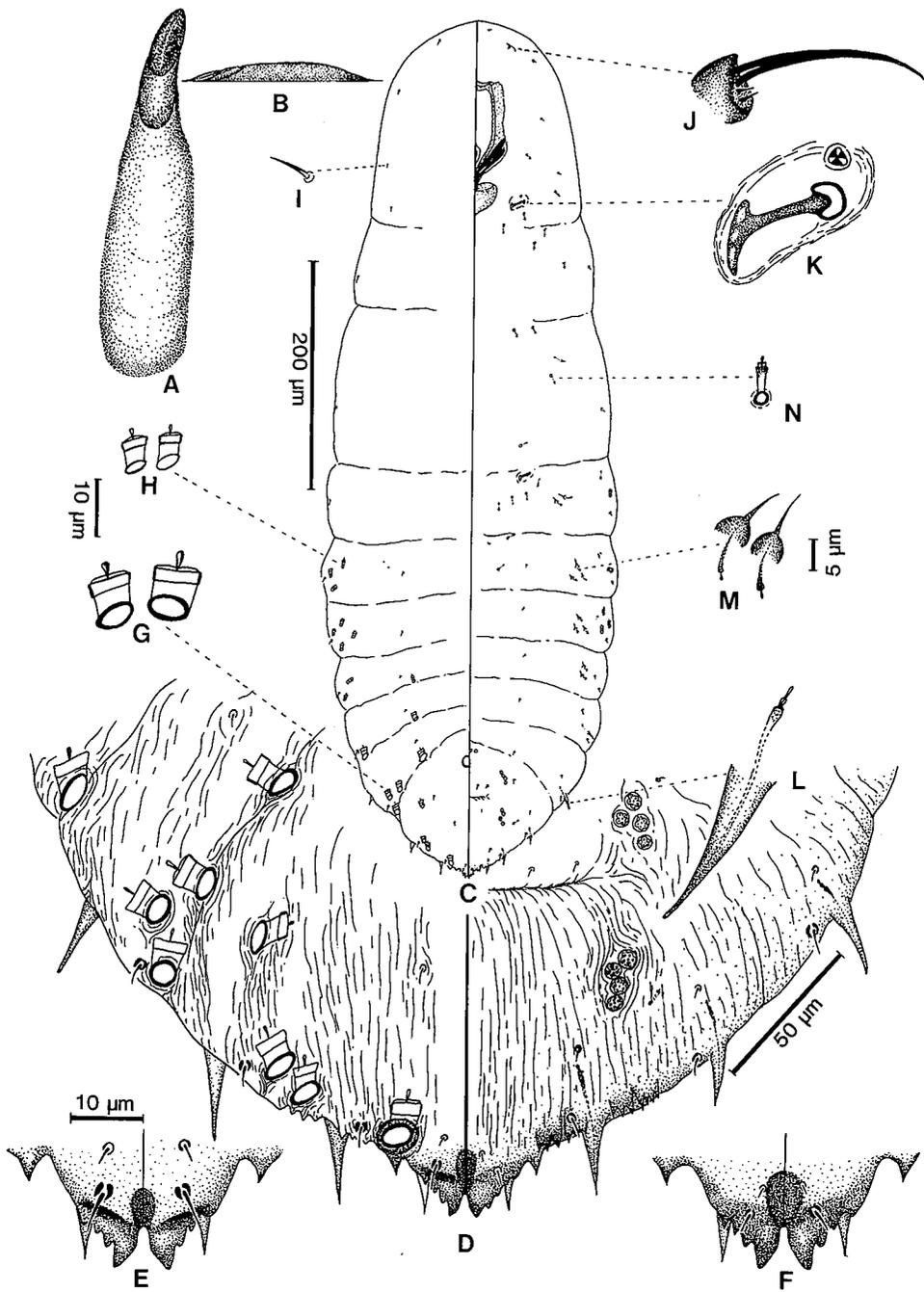


Fig. 1. Adult female of *Neoquernaspis takagii* Liu and Tippins, n. sp.

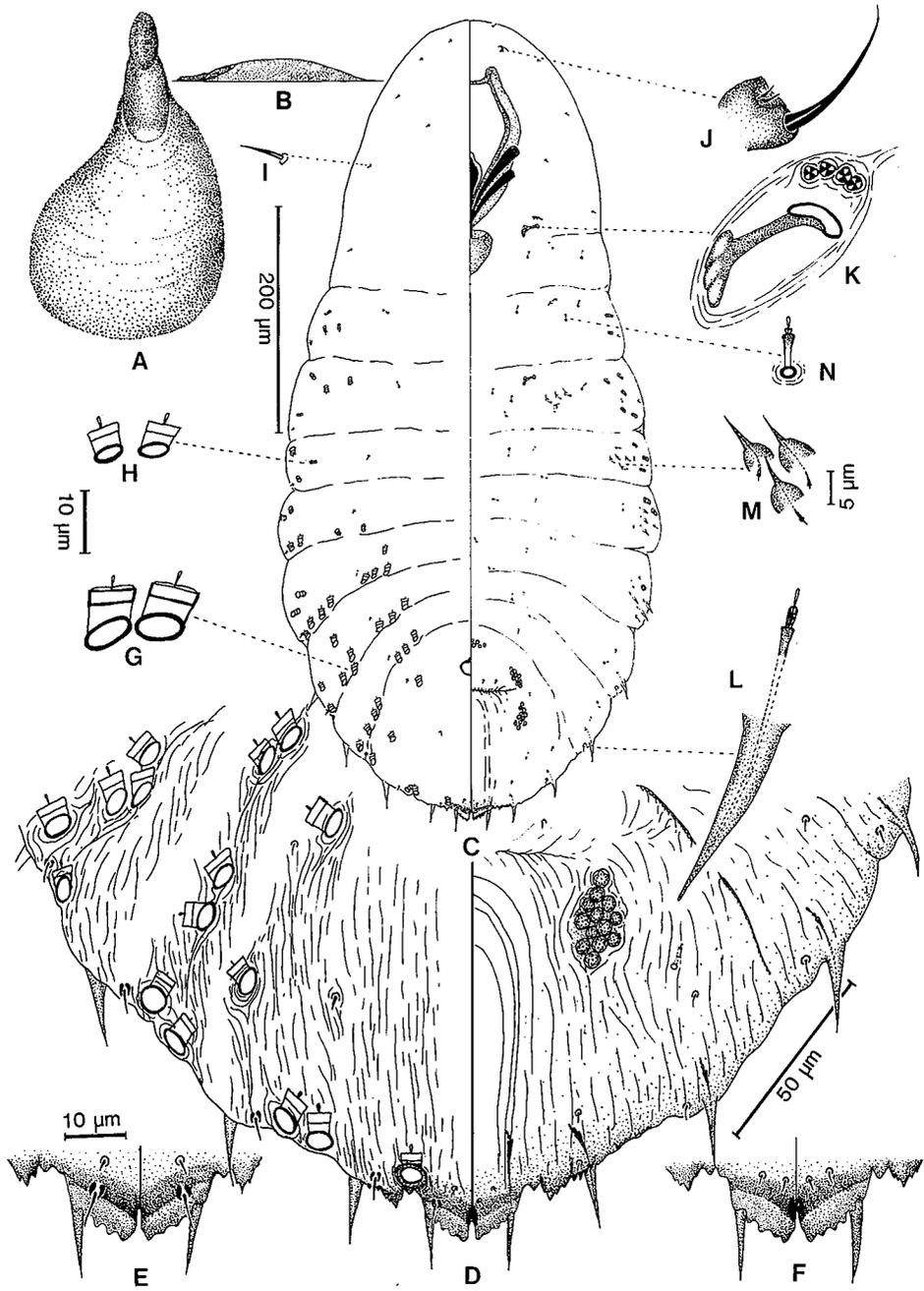


Fig. 2. Adult female of *Neoquernaspis howelli* Liu and Tippins, n. sp.

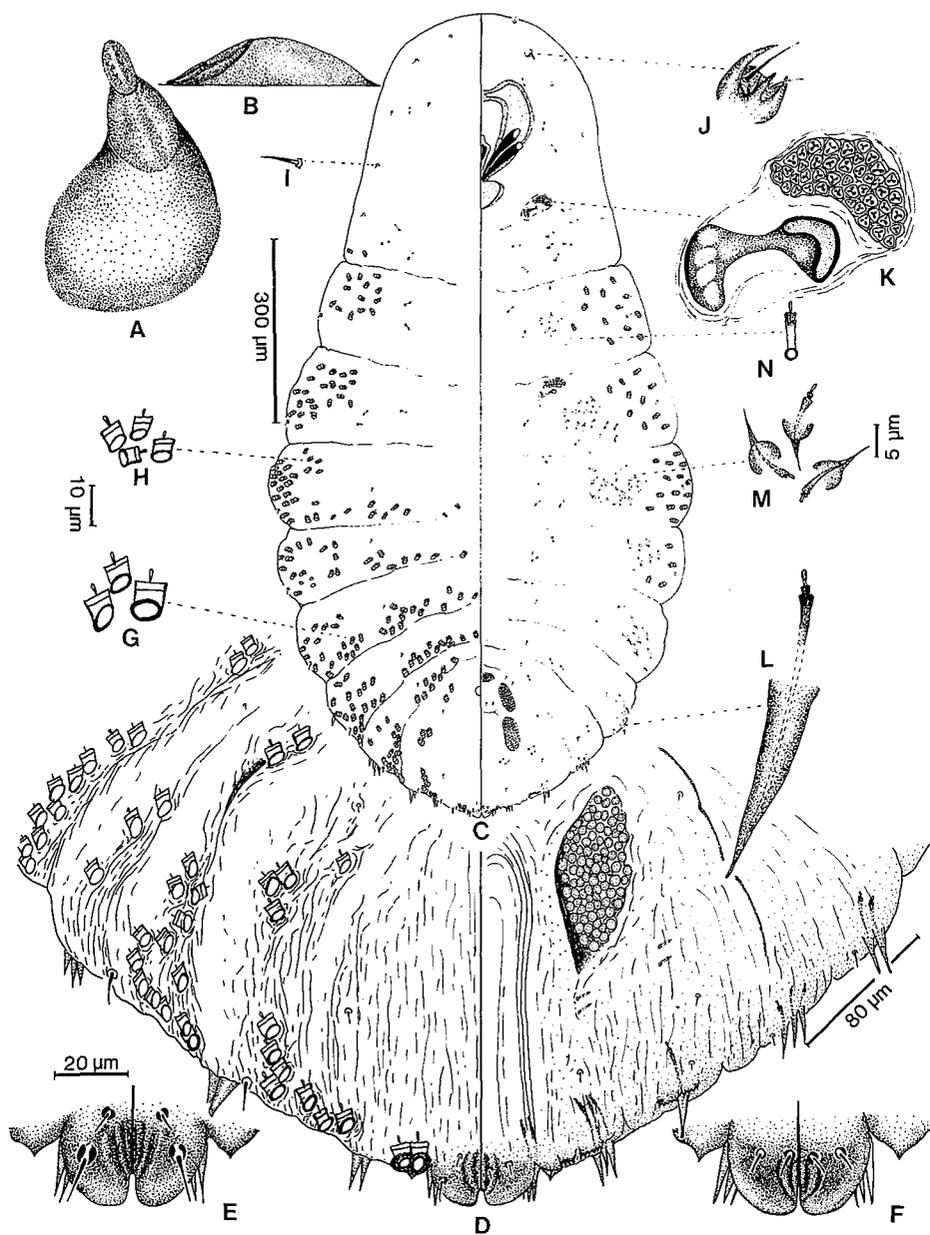


Fig. 3. Adult female of *Neoquernaspis beshearae* Liu and Tippins, n. sp.



Fig. 4. Second instar male of *Neoquernaspis beshearae* Liu and Tippins, n. sp.