

DESCRIPTIONS OF THREE NEW AND SIX NEW RECORD WOLF SPIDER SPECIES FROM TAIWAN (ARACHNIDA: ARANEAE: LYCOSIDAE)

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ABSTRACT. – Wolf spiders (Lycosidae) were examined from material obtained from pitfall traps in various areas of Taiwan. In this paper we described three new species, *Arctosa labiata*, new species, *A. truncata*, new species and *Pirata digitatus*, new species. Six species of Lycosidae were reported from Taiwan for the first time, *Pardosa procurva* Yu & Song, 1988, *Lycosa boninensis* Tanaka, 1989, *Trochosa ruricoloides* Schenkel, 1963, *Wadicosa fidelis* (O. P. Cambridge, 1872), *Pirata denticulatus* Liu, 1987 and *Venonia spirocysta* Cai, 1991. Phenologies of the common Taiwanese lycosids *Pardosa laura* Karsch, 1879, *L. boninensis*, *A. labiata*, and *Hippasa holmerae* Thorell, 1895 were reported according to temporal and spatial abundance of pitfall catches.

KEY WORDS. – *Arctosa*, *Hippasa*, *Lycosa*, *Pardosa*, *Pirata*, *Trochosa*, *Wadicosa*, *Venonia*.

INTRODUCTION

Lycosidae is one of the most diverse family in Araneae and currently more than 2200 species from 100 genera are described (Platnick, 2004). However, only 10 species from four genera are documented in Taiwan (Chen, 1996). Half of them were described by Europeans in the 19th century and the others were reported by Japanese before World War II. Considering the huge diversity of this family, the wolf spider diversity in Taiwan is very likely to be severely underestimated.

This paper is one of the series reports of systematic study on the ground invertebrate fauna of Taiwan. During this study, we found three new species: *Arctosa labiata*, new species, *A. truncata*, new species and *Pirata digitalis*, new species, and six species reported from Taiwan for the first time: *Pardosa procurva* Yu & Song, 1988, *Lycosa boninensis* Tanaka, 1989, *Trochosa ruricoloides* Schenkel, 1963, *Wadicosa fidelis* (O. P. Cambridge, 1872), *Pirata denticulatus* Liu, 1987, and *Venonia spirocysta* Cai, 1991. The wolf spider genera *Arctosa*, *Trochosa*, *Wadicosa* and *Venonia* were reported from Taiwan for the first time. The result of this study had increased the Taiwanese wolf spider diversity from four genera, 10 species to eight genera and 19 species.

Almost nothing is known about the natural history of Taiwanese wolf spiders. In this study, most of the specimens

were obtained from pitfall traps in various parts of Taiwan (Hui-Sun Experimental Forest Station in mid-elevation mountainous area in central Taiwan: Ou, 1999; Wang et al., 2001; Fong-Hong-Kou Bird Park in low elevation mountain area in central Taiwan: Yu et al., 2001; Kenting National Park in southern tropical Taiwan: Hsieh et al., 2003) and the temporal and spatial abundance data of the more dominant species were available. Therefore, in this paper we provide data on habitat preference and phenology of the common species *Pardosa laura* Karsch, 1879, *L. boninensis*, *A. labiata*, and *Hippasa holmerae* Thorell, 1895.

MATERIAL AND METHODS

The work is based on lycosid material collected with pitfall traps established in several localities in western Taiwan in recent years, and a small number of specimens collected from other localities of Taiwan. All specimens were examined and described while kept in 70% EtOH. The epigynes were isolated from the female specimens and were treated by NaOH to remove the muscular tissues and to make the chitinous parts more obvious. The sequence of leg segments in the measurements is as follows: total length (femur, patella, tibia, metatarsus, tarsus). All measurements are given in millimeters.

Abbreviations used in this paper are as follows: AME -

anterior median eye, ALE - anterior lateral eye, PME - posterior median eye, PLE - posterior lateral eye, AME-AME - space between AMEs, AME-ALE - space between AME and ALE. Abbreviations for the collections are: the National Museum of Natural Science, Taiwan (NMNS-THU-Ar-), the Institute of Zoology, Chinese Academy of Sciences, Beijing (IZCAS) and the Zoological Reference Collection of the Raffles Museum of Biodiversity Research, National University of Singapore (ZRC).

TAXONOMY

Pardosa sp. (Figs. 1-5)

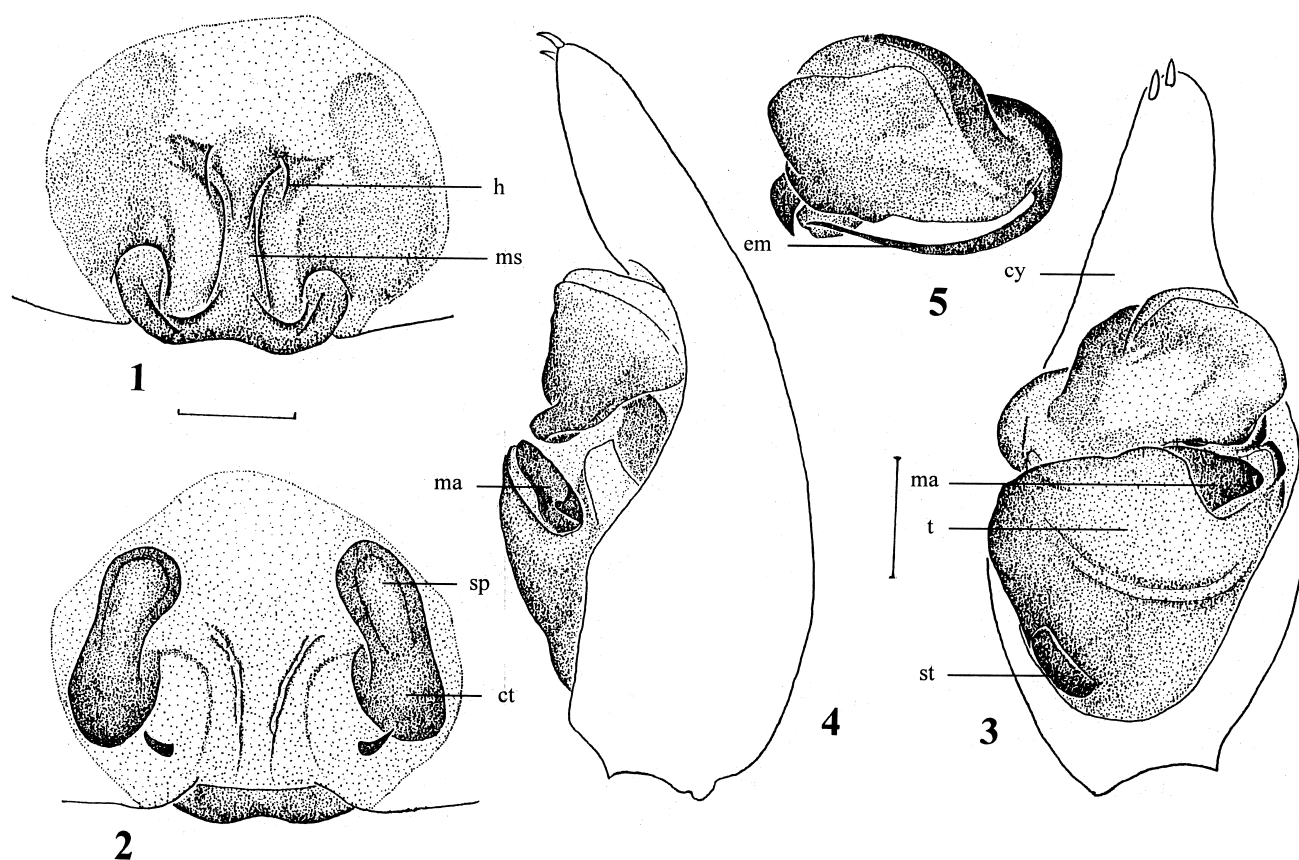
Material examined. - 1 female, Kenting National Park, Pingtung County, Taiwan, Feb.2001, coll. Yu-Lung Hsieh (NMNS-THU-Ar-02-0160); 1 male, Kenting National Park, Pingtung County, Taiwan, Feb.2001, coll. Yu-Lung Hsieh (NMNS-THU-Ar-02-0159); 1 male, Kenting National Park, Pingtung County, Taiwan, Mar.2000, coll. Yu-Lung Hsieh (NMNS-THU-Ar-02-0163).

Diagnosis. - Total length 5.82-6.50; posterior part of median band of carapace with almost parallel and regular lateral margins; legs without annulation; median septum of epigynum inversed "T"-shaped, handle thin and long, anterior margin of expanded part protruding ventrally; median

apophysis of pedipalp organ like a triangular plate, directed laterally, anterior margin slightly waved, distal end hooked, curved ventrally.

Description. - **Female:** Total length 6.50; carapace length 3.13, width 2.45; abdomen length 3.49, width 1.96. Body with brown pubescence. Median band of carapace yellowish brown, distinct, slightly expanded anteriorly and extending between PLEs, posterior part with regular margins; lateral belts brown, wide and continuous; sublateral bands continuous. Anterior eye row slightly procurved, AME larger than ALE distinctly, AME-AME longer than AME-ALE. Chelicerae with 3 promarginal and 3 retromarginal teeth. Legs yellowish brown, without annulation. Epigynum with two hoods, median septum inversed "T"-shaped (Fig. 1), handle thin and long, anterior margin of expanded part protruding ventrally, copulatory tube thick and short, spermatheca slightly expanded (Fig. 2).

Male: One specimen: total length 5.82, carapace length 3.00, width 2.21, abdomen length 2.94, width 1.78. Another specimen: carapace length 3.19, width 2.27 (abdomen damaged). Similar to female in general shape and colour. Pedipalp brown. Cymbium of pedipalp with two thick apical setae. Median apophysis shape like a triangular plate, directed laterally, anterior margin slightly waved, distal end hooked, curved ventrally; embolus thin and long (Figs. 3-5).



Figs. 1-5. *Pardosa* sp. 1-2. epigynum (1. ventral view; 2. dorsal view); 3-4. left pedipalp of male (3. ventral view; 4. retrolateral view); 5. terminal part of right pedipalp (ventral view). Abbreviations: ct: copulatory tube; cy: cymbium; em: embolus; h: hood; ma: median apophysis; ms: median septum; sp: spermatheca; st: subtegulum; t: tegulum. Scale bars: Figs. 1-2 = 0.15 mm; Figs. 3-5 = 0.20 mm.

Distribution. – Taiwan.

Remarks. – This species is similar to *P. oriens* (Chamberlin, 1924). In this species, posterior part of median band of carapace not expanded, with regular lateral margins, lateral belts relatively wide, continuous; anterior margin of median apophysis slightly waved, annulation of legs absent and body relatively larger. In *P. oriens*, posterior part of median band of carapace expanded, with serrated lateral margins, lateral belts broken, anterior margin of median apophysis almost straight, annulation of legs distinct and body relatively smaller.

According to the characters of epigynum and pedipalp, this species should be a member of the *nebulosa*-group. The species of this group are very difficult to be separated from each other. A revision of this group is badly needed, but is currently not available. In order not to arouse more complexity, we decided to identify these specimens just to the genus level.

***Arctosa labiata*, new species**
(Figs. 6-10)

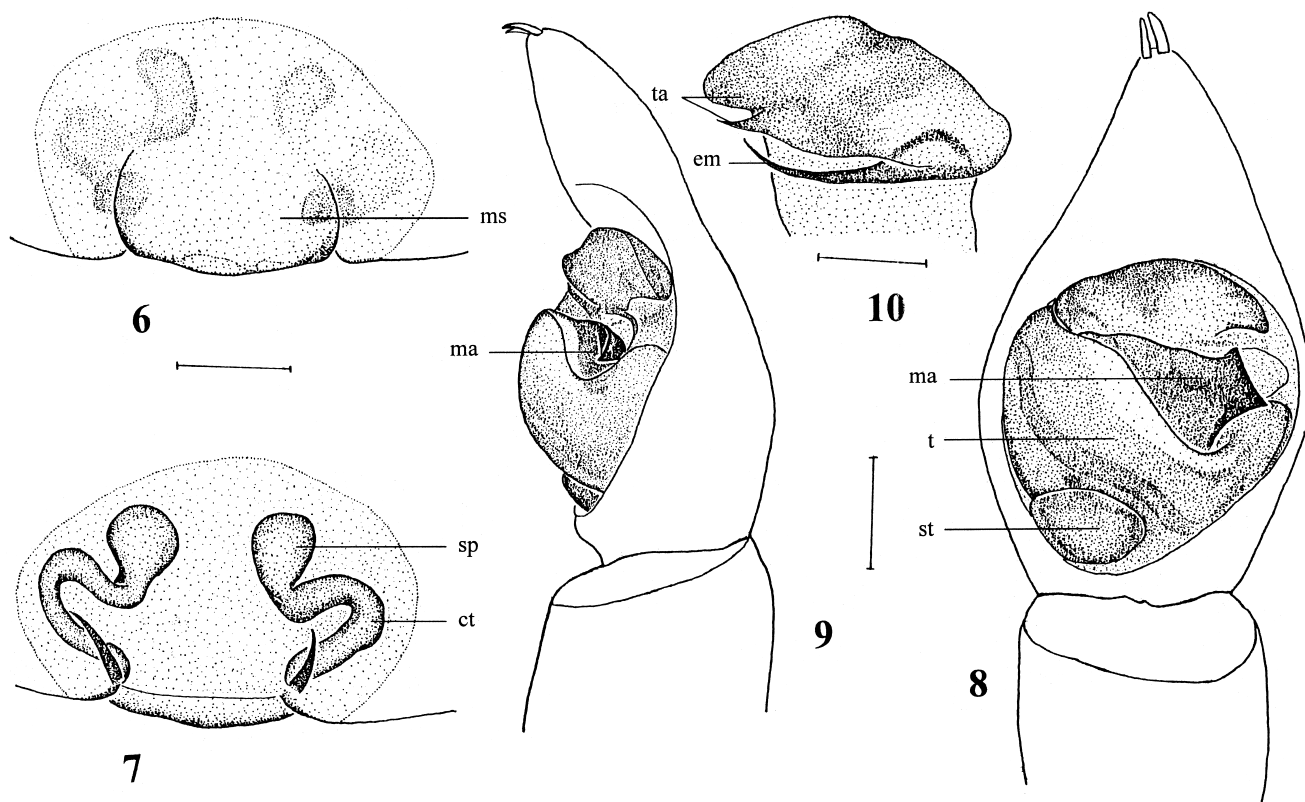
Material examined. – Holotype - female, Kenting National Park, Pingtung County, Taiwan, Jun.2000, coll. Yu-Lung Hsieh (NMNS-THU-Ar-01-0108).

Paratypes – 1 female, Hui-Sun Experimental Forest Station, Nantou County, Taiwan, Aug.1998, coll. Hai-Yin Wu (ZRC); 1 female, Lugu Country, Nantou County, Taiwan, 29 Jan.1996, coll. Wen-Hao Chou (NMNS-THU-Ar-02-0155, in IZCAS, Beijing); 1 male, Hui-Sun Experimental Forest Station, Nantou County, Taiwan, Apr.1998, coll. Hai-Yin Wu (ZRC); 1 male, Hui-Sun Experimental Forest Station, Nantou County, Taiwan, Apr.1998, coll. Hai-Yin Wu (NMNS-THU-Ar-00-0065); 7 males, Kenting National Park, Pingtung County, Taiwan, Apr.2000, coll. Yu-Lung Hsieh (NMNS-THU-Ar-01-0107, 5 in NMNS, Taiwan; 2 in IZCAS, Beijing).

Diagnosis. – Total length 3.92-5.33; carapace with indistinct pattern; epigynum lip-shaped, posterior margin almost straight, copulatory tube long and strongly twisted; median apophysis of pedipalp organ directed laterally, anterior margin concave, distal part pointed, curved ventrally, embolus long and narrowed distally, terminal apophysis bifurcate distally, upper branch wide and obtuse.

Etymology. – The specific name refers to the lip-shaped epigynum of the new species.

Description. – **Female:** Total length: 5.03-5.33. Holotype: total length 5.33, carapace length 2.51, width 1.75; abdomen length 2.94, width 1.84. Body with brown pubescence. Head region sloped laterally. Carapace reddish-brown, with indistinct pattern. Quadrangle of the posterior eyes dark brown, scattered with whitish pubescence and brownish long setae, colour between PLEs reddish-brown. Anterior eye row



Figs. 6-10. *Arcotosa labiata*, new species. 6-7. epigynum (6. ventral view; 7. dorsal view); 8-9. left pedipalp of male (8. ventral view; 9. retrolateral view); 10. terminal part of right pedipalp (ventral view). Abbreviations: ct: copulatory tube; em: embolus; ma: median apophysis; ms: median septum; sp: spermatheca; st: subtégulum; t: tegulum; ta: terminal apophysis. Scale bars: Figs. 6-9 = 0.15mm; Fig. 10 = 0.10mm.

slightly recurved, slightly longer than posterior median eye row, AME slightly smaller than ALE, AME-AME longer than AME-ALE. Clypeus about same length of the diameter of AME. Chelicerae with 3 promarginal and 4 retromarginal teeth. Sternum slightly swollen, colour of margin rather dark. Legs with distinct annulations. Legs measurements: I 5.39 (1.59, 0.86, 1.16, 1.04, 0.74); II 4.90 (1.53, 0.80, 0.98, 0.92, 0.67); III 4.85 (1.35, 0.74, 0.86, 1.10, 0.80); IV 7.17 (1.96, 0.92, 1.35, 1.96, 0.98). Dorsum of abdomen longitudinally with several pairs of pale spots behind the heart stripe. Median septum of epigynum lip-shaped, posterior margin almost straight (Fig. 6), copulatory opening invisible, copulatory tube long and strongly twisted, spermatheca expanded, round (Fig. 7).

Male: Total length 3.92-5.09. One paratype: total length 5.09, carapace length 2.64, width 1.84; abdomen length 2.57, width 1.53. Similar to female in general shape and colour. Body slightly dark. Anterior eye row almost straight, AME-AME slightly longer than AME-ALE. Sternum brown. Femura of legs brown, other segments yellowish-brown, with distinct annulations. Legs measurements: I 5.96 (1.72, 0.92, 1.29, 1.23, 0.80); II 5.09 (1.53, 0.86, 0.80, 1.16, 0.74); III 5.10 (1.41, 0.74, 0.86, 1.35, 0.74); IV 7.42 (2.02, 0.92, 1.41, 2.15, 0.92). Cymbium of pedipalp with two thick apical setae. Median apophysis directed laterally, anterior margin concave, distal part pointed, curved ventrally; embolus long and narrowing distally, distal part thin and long; terminal apophysis bifurcate distally, upper branch wide and obtuse.

Remarks. – This species is very similar to *A. meitanensis* Yin et al., 1993. It differs from the latter by following: in *A. labiata*, posterior margin of median septum almost straight,

copulatory opening invisible, copulatory tube long and strongly twisted, upper branch of terminal apophysis wide and obtuse; in *A. meitanensis*, posterior margin of median septum arched distinctly, copulatory opening visible, copulatory tube short and slightly curved, upper branch of terminal apophysis narrow, pointed, digitiform.

Distribution. – Taiwan.

***Arctosa truncata*, new species**
(Figs. 11-16)

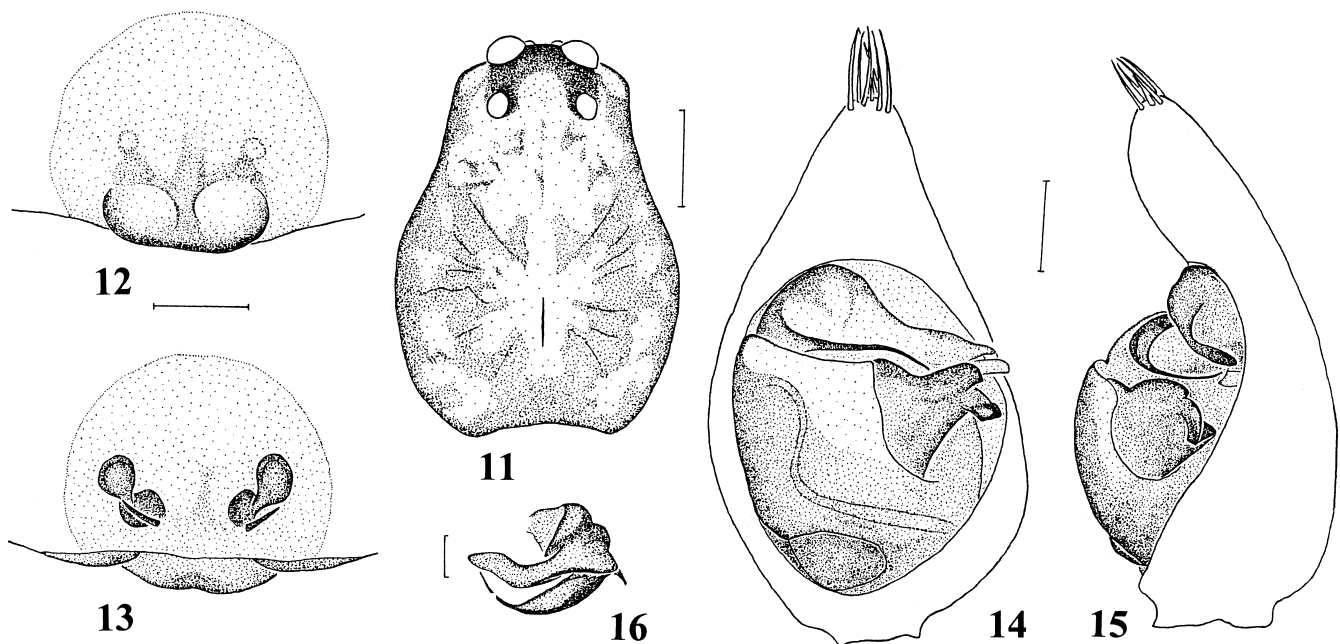
Material examined. – Holotype - female, Lugu Country, Nantou County, Taiwan, 26 Aug. 1995, coll. Wen-Hao Chou (NMNS-THU-Ar-02-0158).

Paratype – 1 male, Lugu Country, Nantou County, Taiwan, 24 Aug. 1995, coll. Wen-Hao Chou (NMNS-THU-Ar-02-0156).

Diagnosis. – Total length 4.66-5.88; carapace with distinct pattern; epigynal plate of female with a pair of slightly concaved lateral hollows; pedipalp with several thick setae clustering together, median apophysis triangle shaped, directed laterally, distal part twisted in 90° and curved ventrally, distal margin truncated, embolus slightly twisted, distal part thin and long, terminal apophysis slightly curved.

Etymology. – The specific name refers to the truncated distal part of the median apophysis.

Description. – **Female:** Holotype: Total length 5.88, carapace length 3.13, width 2.27; abdomen length 2.88, width 1.96. Body brown. Head sloped laterally. Carapace with distinct



Figs. 11-16. *Arctosa truncata*, new species. 11. carapace (female, dorsal view); 12-13. epigynum (12. ventral view; 13. dorsal view); 14-15. left pedipalp of male (14. ventral view; 15. retrolateral view); 16. terminal part of right pedipalp (ventral view). Scale bars: Fig. 11 = 0.80mm; Figs. 12-15 = 0.15mm; Fig. 16 = 0.10mm.

pattern (Fig. 11), median band extending anteriorly between PLEs; lateral bands broken; sublateral bands narrow; margins of carapace dark brown. Anterior eye row almost straight, AME slightly larger than ALE, AME-AME longer than AME-ALE. Clypeus about 0.9 times the diameter of AME. Chelicerae with 3 promarginal teeth and 3 retromarginal teeth. Sternum yellowish-brown, with brown spots along margins. Legs and pedipalp with distinct annulations. Leg measurements: I 7.35 (2.15, 0.98, 1.65, 1.59, 0.98); II 6.86 (1.96, 0.98, 1.41, 1.53, 0.98); III 6.62 (1.90, 0.92, 1.23, 1.65, 0.92); IV 9.93 (2.70, 1.23, 2.02, 2.76, 1.22). Dorsum of abdomen scattered with whitish pubescence, and with pale spots along and behind heart stripe; middle part of venter brown, lateral yellowish. Epigynal plate with a pair of slightly concaved lateral hollows (Fig. 12), copulatory openings not distinct, copulatory tube short, spermathecae expanded, round (Fig. 13).

Male: Total length 4.66, carapace length 2.70, width 2.02; abdomen length 2.08, width 1.47. Similar to female in general shape and colour. Body slightly darker than female. Clypeus about 0.6 times the diameter of AME. Legs measurements: I 7.04 (1.96, 0.92, 1.59, 1.53, 1.04); II 6.44 (1.72, 0.86, 1.35, 1.47, 1.04); III 5.93 (1.65, 0.67, 1.16, 1.59, 0.86); IV 9.20

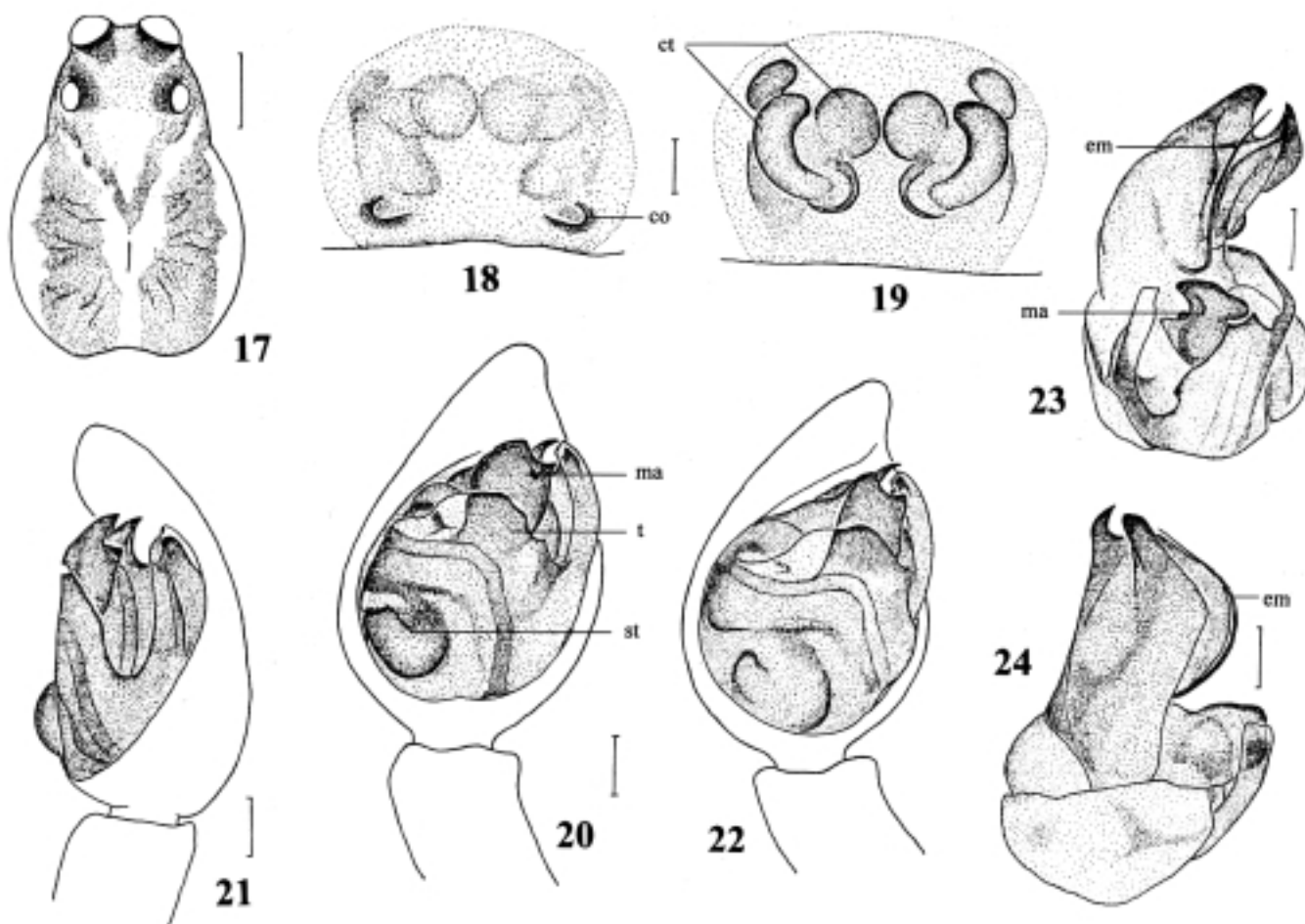
(2.33, 0.98, 1.96, 2.70, 1.23). Pedipalp with several thick setae clustering together. Median apophysis triangular, directed laterally, distal part twisted in 90° and curved ventrally, distal margin truncated (Figs. 14-15); embolus narrow, slightly twisted; terminal apophysis slightly curved (Fig. 16).

Remarks. – This species is very close to *Arctosa xunyangensis* Wang & Qiu, 1992. It can be distinguished from the latter by following: in *A. truncata*, body smaller (female length 5.88, male length 4.66), copulatory opening not distinct, distal part of median apophysis truncated; in *A. xunyangensis*, body larger (female length 7.50-8.20, male length 5.20-5.70), copulatory opening distinct, distal part of median apophysis pointed and long.

Distribution. – Taiwan.

***Pirata digitatus*, new species**
(Figs. 17-24)

Material examined. – Holotype - female, Hui-Sun Experimental Forest Station, Nantou County, Taiwan, 24 Apr. 1998, coll. Sheng-Hai Wu (NMNS-THU-Ar-00-0061).



Figs. 17-24. *Pirata digitatus*, new species. 17. carapace (female, dorsal view); 18-19. epigynum (18. ventral view; 19. dorsal view); 20-22. left pedipalp of male (20. ventral view; 21. retrolateral view; 22. prolateral view); 23-24. right pedipalp of male (expanded, 23. ventral view; 24. dorsal view). Abbreviations: co: copulatory opening; ct: copulatory tube; em: embolus; ma: median apophysis; st: subtegulum; t: tegulum. Scale bars: Fig. 17 = 0.40mm; Figs. 18-19 = 0.05mm; Figs. 20-24 = 0.10mm.

Paratypes – 1 female, Hui-Sun Experimental Forest Station, Nantou County, Taiwan, 24 Apr.1998, coll. Sheng-Hai Wu (ZRC); 1 female, Hui-Sun Experimental Forest Station, Nantou County, Taiwan, Feb.1998, coll. Hai-Yin Wu (NMNS- THU-Ar-00-0063); 1 male, Hui-Sun Experimental Forest Station, Nantou County, Taiwan, 24 Apr.1998, coll. Sheng-Hai Wu (NMNS-THU-Ar-00-0008); 1 male, Hui-Sun Experimental Forest Station, Nantou County, Taiwan, 24 Apr.1998, coll. Sheng-Hai Wu (ZRC).

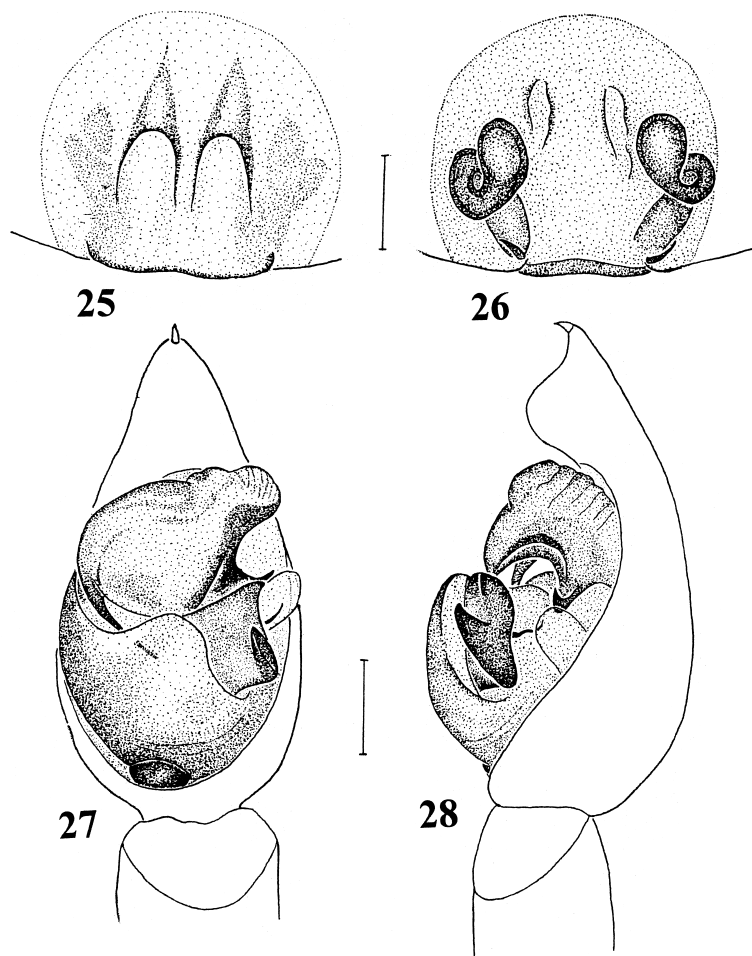
Diagnosis. – Total length 2.88-3.80; carapace with distinct pattern, V-shaped dark mark distinct, sublateral belt absent; epigynum with a pair of copulatory openings near posterior margin, copulatory tube bifurcate at base, terminal part of inner tube expanded, lateral tube with a digitiform prominent distally, its tip beyond that of inner tube; cymbium of pedipalp of male without thick apical seta, median apophysis near rectangle shaped, anterior margin incurved distinctly.

Etymology. – The specific name refers to the distal digitiform prominence of lateral copulatory duct of the epigynum.

Description. – **Female:** Total length 2.91-3.80. Holotype: total length 3.80, carapace length 1.78, width 1.29; abdomen length 2.08, width 1.56. Body with brownish pubescence. Head vertical laterally. Carapace with distinct pattern (Fig. 17), median band yellowish-brown, V-shaped dark mark

distinct; lateral band wide, radiating stripes relatively distinct; lateral bands yellowish-brown, wide; sublateral belt absent. Margin of carapace pale. Bases of posterior eyes dark, colour between them pale and that between PLEs yellowish-brown. Anterior eye row procurved, AME smaller than ALE, AME-AME subequal to AME-ALE. Clypeus about twice the diameter of AME. Chelicerae with 3 promarginal and 3 retromarginal teeth. Sternum slightly swollen, yellowish-brown, with an obscure “U”-shaped dark median mark. Legs yellowish brown, with distinct annulations. Tarsi of pedipalps and legs slightly darker. Leg measurements: I 4.80 (1.34, 0.57, 1.17, 1.10, 0.62); II 4.32 (1.24, 0.53, 0.98, 1.00, 0.57); III 4.24 (1.19, 0.50, 0.86, 1.12, 0.57); IV 6.27 (1.69, 0.62, 1.48, 1.72, 0.76). Dorsum of abdomen dark brown, heart stripe pale, with several transversal bands posteriorly; ventral side pale, muscle marks distinct, dark brown. Epigynum with a pair of copulatory openings near posterior margin in ventral view (Fig. 18); copulatory tube bifurcate at base, terminal part of inner tube expanded, lateral tube with a digitiform prominent distally, the tip beyond that of inner tube (Fig. 19).

Male: Total length: 2.88-3.06. One paratype: total length 3.06, carapace length 1.72, width 1.23; abdomen length 1.38, width 0.86. Similar to female in general shape and colour. Body rather dark. AME smaller than ALE. Clypeus about 1.6 times



Figs. 25-28. *Pardosa procurva* Yu & Song, 1988. 25-26. epigynum (25. ventral view; 26. dorsal view); 27-28. left pedipalp of male (27. ventral view; 28. retrolateral view). Scale bars: Figs. 25-28 = 0.15mm.

the diameter of AME. Annulations of legs indistinct. Leg measurements: I (lost); II 4.32 (1.22, 0.50, 0.93, 1.05, 0.62); III 4.13 (1.17, 0.45, 0.84, 1.10, 0.57); IV 6.08 (1.60, 0.57, 1.41, 1.74, 0.76). Pedipalp yellowish brown, with brown pubescence, distal part of femur and tibia dark coloured, cymbium without thick apical seta. Median apophysis near rectangle shaped, anterior margin incurved distinctly (Figs. 20-24).

Remarks. – The genus *Pirata*, similar to most other genera of Lycosidae, awaits detailed revision based mainly on morphological characters of pedipalp. Considering the distinct V-shaped dark mark in the median band of carapace of this species, we temporarily placed this species in *Pirata*, although its pedipalp is diagnostic.

This species is similar to *P. piraticus* (Clerck, 1757) and *P. subpiraticus* (Bösenberg & Strand, 1906), but can be distinguished easily by the following characters: in *P. digitatus*, anterior eye row procurved, AME smaller than ALE, AME-AME subequal to AME-ALE; posterior margin of epigynal plate almost straight; copulatory tube bifurcate at base, lateral tube with a digitiform prominence distally, tip beyond that of inner tube; median apophysis of pedipalp near rectangle shaped, anterior margin incurved distinctly; in *P. piraticus*, anterior eye row straight, AME distinctly

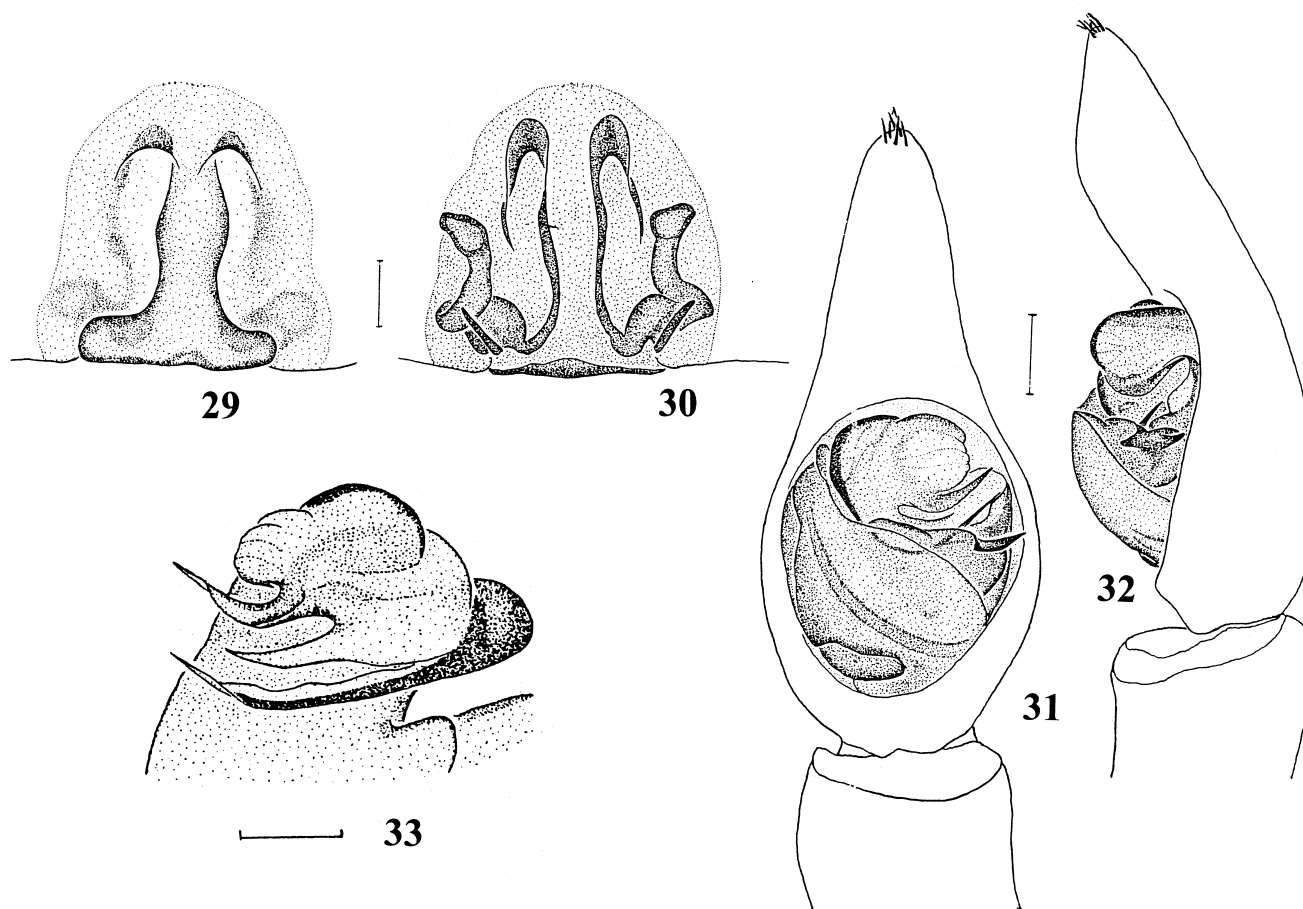
larger than ALE, AME-AME longer than AME-ALE; posterior margin of epigynal plate concave strongly; copulatory tube bifurcate at base, lateral tube without prominent, tip of inner tube beyond that of lateral tube; median apophysis of pedipalp organ like a bird head in ventral view; in *P. subpiraticus*, anterior eye row almost straight, AME larger than ALE, AME-AME longer than AME-ALE; posterior margin of epigynal plate concave strongly; copulatory tube bifurcate at base, lateral tube without prominent, tip of inner tube beyond that of lateral tube; median apophysis of pedipalp organ digit shaped, directed laterally.

Distribution. – Taiwan.

***Pardosa procurva* Yu & Song, 1988**
(Figs. 25-28)

Pardosa procurva Yu & Song, 1988a: 30, Figs. 14-19; Chen & Zhang, 1991: 205, Fig. 208; Yin et al., 1997: 276, Fig. 131; Song et al., 1999: 333, Figs. 197E, K.

Material examined. – 1 female, Kenting National Park, Pingtung County, Taiwan, Sep.2000, coll. Yu-Lung Hsieh (NMNS-THU-Ar-02-0162); 1 female, Kenting National Park, Pingtung County, Taiwan, Sep.2000, coll. Yu-Lung Hsieh (NMNS-THU-Ar-02-165); 1 male, Kenting National Park, Pingtung County, Taiwan, Sep.2000, coll. Yu-Lung Hsieh (NMNS-THU-Ar-02-161).



Figs. 29-33. *Lycosa boninensis* Tanaka, 1989. 29-30. epigynum (29. ventral view; 30. dorsal view); 31-32. left pedipalp of male (31. ventral view; 32. retrolateral view); 33. terminal part of right pedipalp (ventral view). Scale bars: Figs. 29-30 = 0.15mm; Figs. 31-32 = 0.25mm; Fig. 33 = 0.15mm.

Description. – Female: Total length 4.23-4.60. One specimen: total length 4.23, carapace length 2.21, width 1.65; abdomen length 2.08, width 1.35. Body with brown pubescence. Median band of carapace distinct. Anterior eye row strongly procurved, AME larger than ALE, AME-AME longer than AME-ALE. Legs yellowish-brown, without annulation; femur of leg I darker. Epigynum with two big hoods, “m”-shaped (Fig. 25); copulatory tube thin and long, strongly twisted; spermathecae expanded (Fig. 26).

Male. – Total length 3.80, carapace length 2.02, width 1.59, abdomen length 1.90, width 0.92. Similar to female in general shape and colour. Pedipalp brown. Cymbium tip with one thick apical seta. Median apophysis rectangular when viewed ventrally (Fig. 27), posterior sclerite elongated, and directed ventrally (Fig. 28).

Distribution. – Taiwan, Fujian, Zhejiang, Hunan, Yunnan, Guizhou, Sichuan.

***Lycosa boninensis* Tanaka, 1989**

(Figs. 29-33)

Lycosa boninensis Tanaka, 1989: 89, Figs. 1-4; 1990: 208, Figs. 15-18.

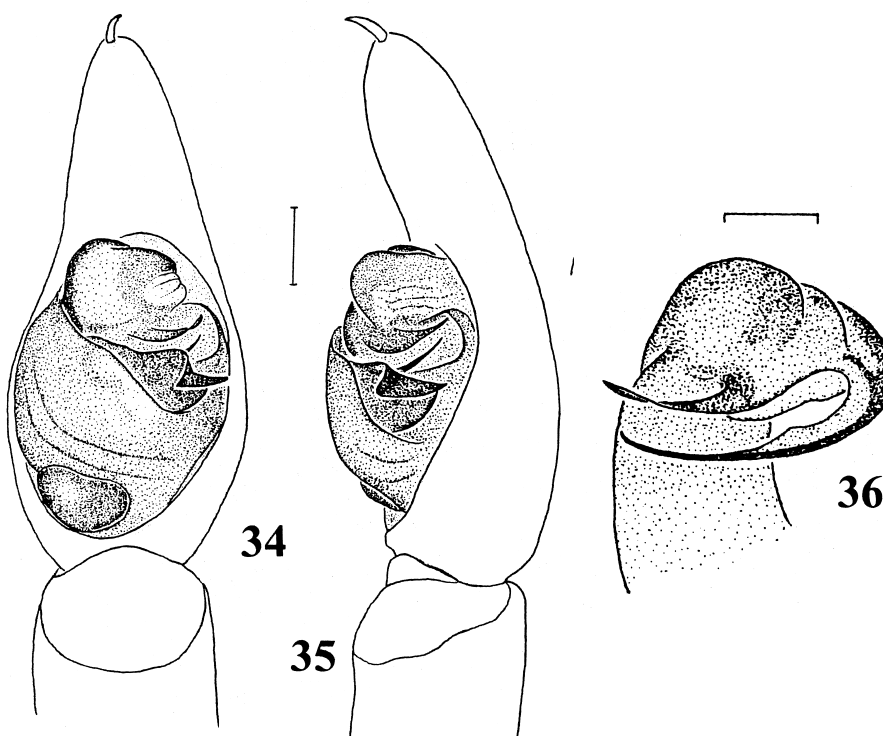
Material examined. – 1 female, Kenting National Park, Pingtung County, Taiwan, Sep.2000, coll. Yu-Lung Hsieh (NMNS-THU-Ar-01-0103); 1 female, Kenting National Park, Pingtung County, Taiwan, Mar.2000, coll. Yu-Lung Hsieh (NMNS-THU-Ar-02-0169); 1 male, Kenting National Park, Pingtung County, Taiwan, Feb.2000, coll. Yu-Lung Hsieh (NMNS-THU-Ar-01-0101).

Description. – Female: Total length 9.93 - 11.34. One specimen: total length 10.42, carapace length 5.52, width 3.98; abdomen length 5.09, width 3.06. Body brown. Median band of carapace very distinct, anterior part slightly broader, extending anteriorly between PLEs; posterior part with straight margins; lateral bands indistinct. Anterior eye row slightly procurved, AME much larger than ALE, AME-AME subequal to AME-ALE. Legs with distinct annulations. Epigynum with two hoods, median septum inversed “T”-shaped (Fig. 29); copulatory tube thin and short, spermathecae expanded, irregular shaped (Fig. 30).

Male: Carapace length 5.76, width 4.35 (abdomen damaged). Similar to female in general shape and colour. Cymbium with several thick setae clustered together. Median apophysis triangular shaped and directed laterally, with a triangular prominence directed to ventral side on anterior margin (Figs. 31-32).

Distribution. – Taiwan; Japan.

Remarks. – Zyuzin & Logunov (2000) gave a comprehensive and up-to-date definition of *Lycosa*, which based mainly on morphological characters of copulatory organs, mating mechanism and habitats. According to this definition, some described species of *Lycosa* should be moved to other genera. Here, we temporarily place this species in *Lycosa*, although the character states of copulatory organs are not congruent with the diagnosis of *Lycosa* given by Zyuzin & Logunov (2000) but more with that of *Honga*. With more revision work on these mega genera, these problems will be solved.



Figs. 34-36. *Trochosa ruricoloides* Schenkel, 1963. 34-36. left pedipalp of male (34. ventral view; 35. retrolateral view); 36. terminal part of right pedipalp (ventral view). Scale bars: Figs. 34-35 = 0.15mm; Fig. 36 = 0.10mm.

***Trochosa ruricoloides* Schenkel, 1963**
(Figs. 34-36)

Trochosa ruricoloides Schenkel, 1963: 350, Fig. 202; Zhu, 1983: 76; Yin et al., 1995: 28, Figs. 23-29; Yin et al., 1997: 157, Fig. 74; Song et al., 1999: 345, Figs. 201I, Q.

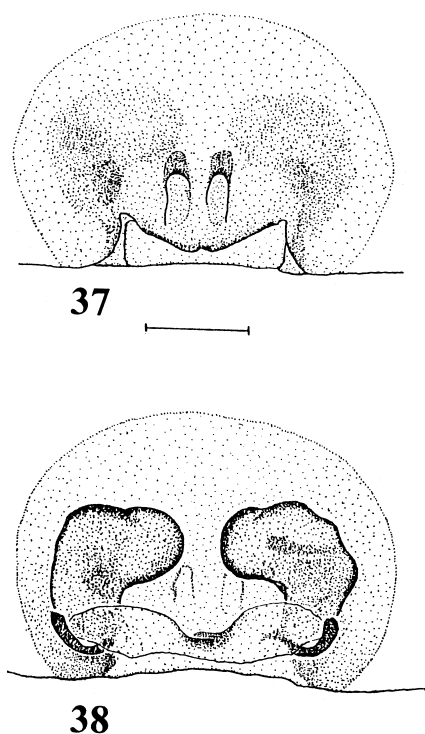
Material examined. – 1 male, Kenting National Park, Pingtung County, Taiwan, Mar.2000, coll. Yu-Lung Hsieh (NMNS-THU-Ar-01-0104); 1 male, Kenting National Park, Pingtung County, Taiwan, Jul.2000, coll. Yu-Lung Hsieh (NMNS-THU-Ar-02-0166).

Description. – **Male:** One specimen: total length 6.37, carapace length 3.37, width 2.33; abdomen length 3.19, width 1.59. Another specimen: carapace length 2.82, width 2.02 (abdomen damaged). Body pale. Median band of carapace distinct, anterior part with a pair of longitudinal dark marks. Anterior eye row slightly recurved, AME larger than ALE. Annulations of legs indistinct. Cymbium of pedipalp with a thick terminal setae. Median apophysis of pedipalp organ rectangular shaped and directed laterally, distal half part of its anterior margin folded toward ventral side, and base of this part slightly extended toward inside, forming an angular prominence (Figs. 34-35).

Distribution. – Taiwan, Hainan, Guangdong, Fujian, Jiangxi, Zhejiang, Hunan, Hubei, Yunnan, Tibet, Sichuan, Shaanxi.

***Wadicosa fidelis* (O. P. -Cambridge, 1872)**
(Figs. 37, 38)

Lycosa fidelis O. P.-Cambridge, 1872: 319.
Lycosa galerita L. Koch, 1875: 69, pl. 7, Fig. 1; Simon, 1876: 269;
Lycosa indistincte-picta Strand, 1907: 567; Strand, 1909: 81, Fig. 44.



Figs. 37-38. *Wadicosa fidelis* (O. P. -Cambridge, 1872). 37-38. epigynum (37. ventral view; 38. dorsal view). Scale bars: Figs. 37-38 = 0.25mm.

Pardosa armillata Schenkel, 1936: 218, Fig.70; Zyuzin, 1979: 434, Fig. 27; Hu, 1984: 233, Figs. 240.1-4; Chen & Gao, 1990: 126, Figs. 155a-b.

Lycosa biarmillatana Strand, 1942: 398.
Pardosa kraepelini Roewer, 1959: 51, Figs. 13a-d.

Pardosa paraarmillata Schenkel, 1963: 376, Figs. 218a-c.

Pardosa venatrix (non *Lycosa venatrix* Lucas, 1864): Buchar, 1980: 88, Figs. 28-29; Yu & Song, 1988b: 117; Chen & Zhang, 1991: 201, Figs. 201, 202.1-4; Pan, 1995: 144, Figs. 1-3; Song, Chen & Zhu, 1997: 1723, Figs. 28a-c; Hu, 2001: 206, Figs. 106.1-4.

Wadicosa venatrix (non *Lycosa ventrix* Lucas, 1864): Zyuzin, 1985: 49; Yin et al., 1997: 286, Fig. 135; Tanaka, 2000: 95, Fig. 2.
Wadicosa fidelis (O. P.-Cambridge, 1872): Wunderlich, 1992: 467, Figs. 727-728. Song et al., 1999: 346, Figs. 202C, G; Platnick, 2003.

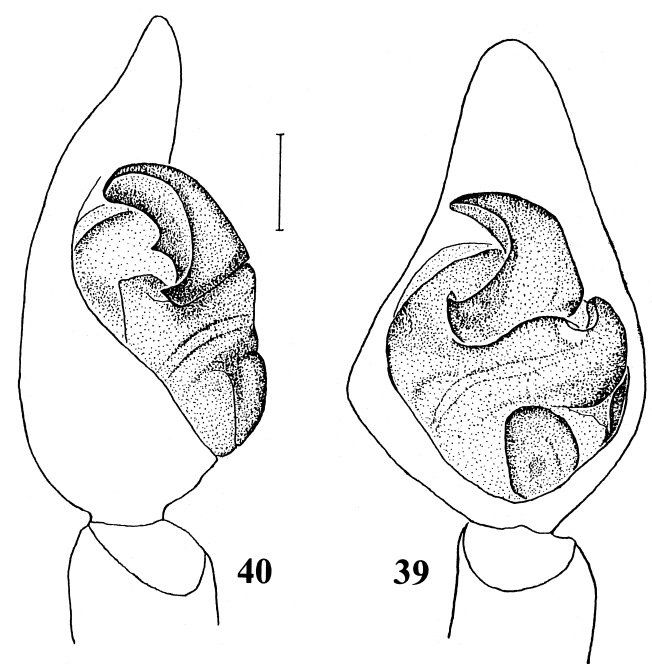
Material examined. – 1 female, Taipei City, Taiwan, 31 Mar.1998, coll. Shu-Jin Chen (NMNS-THU-Ar-00-0071).

Description. – **Female:** Total length 7.66: carapace length 3.68, width 3.00; abdomen length 4.17, width 2.64. Carapace with distinct pattern, median band wide; lateral bands broken. Leg with distinct annulations. Epigynal plate wide, anterior half part with a pair of concave pits (Fig. 37), posterior half part concave, spermatheca large, irregular shaped (Fig. 38).

Distribution. – Taiwan, Hainan, Guangdong, Guangxi, Fujian, Jiangxi, Zhejiang, Hunan, Hubei, Yunnan, Sichuan; Palearctic.

***Pirata denticulatus* Liu, 1987**
(Figs. 39, 40)

Pirata denticulata Liu, 1987a: 46, pl. 2, Fig. 8 (nomen nudum); Liu, 1987b: 367, Figs. 1-6; Chen & Zhang, 1991: 211, Figs. 215.1-6; Yin et al., 1997: 29, Fig. 10.



Figs. 39-40. *Pirata denticulatus* Liu, 1987. 39-40. right pedipalp of male (39. ventral view; 40. retrolateral view). Scale bars: Figs. 39-40 = 0.15mm.

Pirata denticulatus: Platnick, 1989: 385; Song et al., 1999: 335, Figs. 200F, R.

Material examined. – 1 male, Hui-Sun Experimental Forest Station, Nantou County, Taiwan, Apr. 1998, coll. Hai-Yin Wu (NMNS-THU-Ar-00-0010).

Description. – **Male:** Total length 3.49: carapace length 1.90, width 1.35; abdomen length 1.78, width 1.04. Body pale. Carapace with sublateral bands, narrow and short; margin of carapace black. Anterior eye row procurved, AME subequal to ALE in size, AME-AME subequal to AME-ALE. Annulations of legs indistinct. Tarsus of pedipalp without thick setae. Median apophysis of pedipalp organ “C”-shaped, median part of inner margin with a triangular prominence (Figs. 39-40).

Distribution. – Taiwan, Guangxi, Fujian, Zhejiang, Hunan, Guizhou.

***Venonia spirocysta* Cai, 1991**
(Figs. 41-44)

Venonia spirocysta Cai, in Chen & Zhang, 1991: 208, Figs. 211.1-4; Cai, 1993: 60, Figs. 1-16; Yin et al., 1997: 50, Fig. 21; Song et al., 1999: 346, Figs. 202A, E.

Material examined. -1 female, Kenting National Park, Pingtung County, Taiwan, Apr. 2000, coll. Yu-Lung Hsieh (NMNS-THU-Ar-02-0168); 1 male, Kenting National Park, Pingtung County, Taiwan, Apr. 2000, coll. Yu-Lung Hsieh (NMNS-THU-Ar-01-0106); 2 males, Lugu Country, Nantou County, Taiwan, 25 Aug. 1995, coll. Wen-Hao Chou (NMNS-THU-Ar-02-0157).

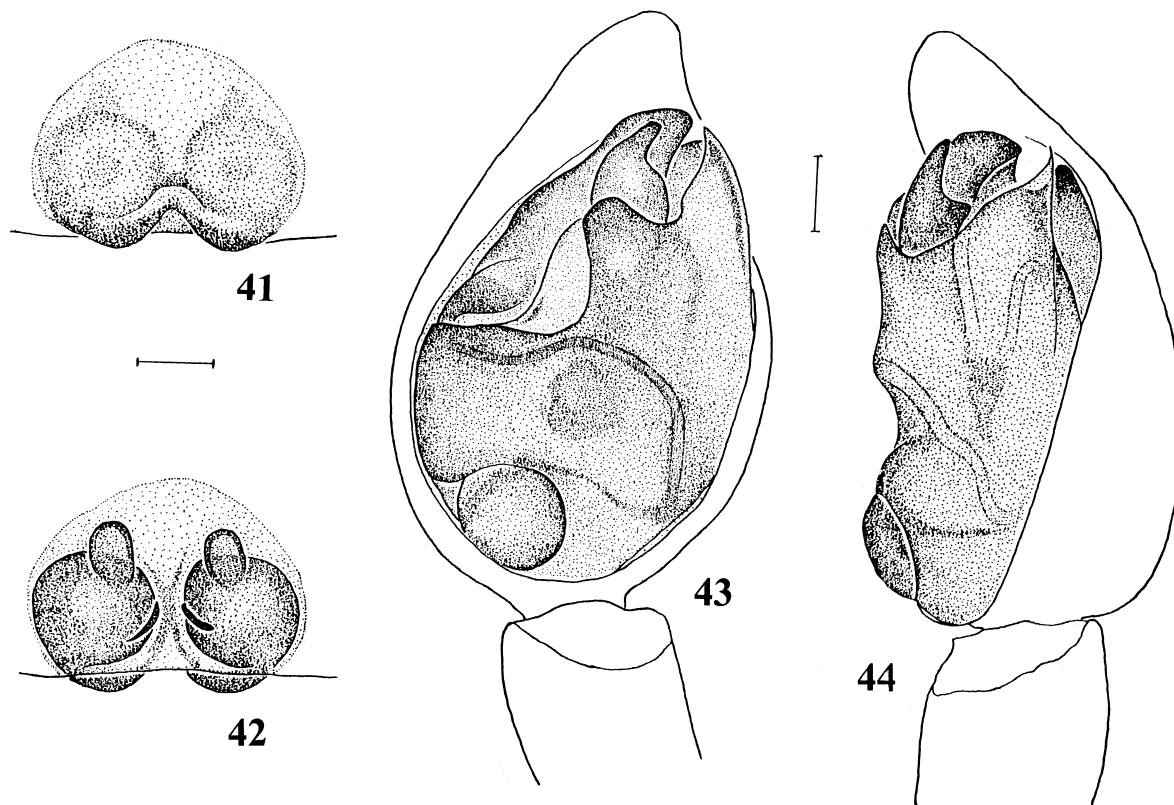
Description. – **Female:** Total length 4.05: carapace length 1.90, width 1.35; abdomen length 2.27, width 1.53. Body with brown pubescence. Median band of carapace yellowish-brown, distinct, narrowing backward. Anterior eye row procurved, AME larger than ALE, AME-AME slight shorter than AME-ALE. Chelicerae with 3 teeth on both promargin and retromargin. Legs yellowish-brown, with brown annulations. Posterior margin of epigynal plate concave (Figs. 41-42).

Male: Total length 2.57-3.37. One specimen: total length 2.70, carapace length 1.53, width 1.16; abdomen length 1.29, width 0.92. Similar to female in general shape and colour. Median band of carapace narrow, indistinct. Annulations of legs almost indistinguishable. Femur of leg I and pedipalp dark brown in colour. Tarsus of pedipalp without thick terminal setae, cymbium relatively large, genital bulb almost occupying the whole tarsus. Median apophysis pointing anteriorly (Figs. 43-44).

Distribution. – Taiwan, Guangxi, Fujian, Jiangxi, Zhejiang, Hunan, Guizhou.

PHENOLOGY OF COMMON TAIWANESE LYCOSIDS

***Pardosa laura* Karsch, 1879.** – This species is very abundant in Fong-Hong Ku Bird Park, which is situated at the low elevation mountainous area of central Taiwan. More than 90% of the spiders collected by pitfall are composed of this species.



Figs. 41-44. *Venonia spirocysta* Cai, 1991. 41-42. epigynum (41. ventral view; 42. dorsal view); 43-44. left pedipalp of male (43. ventral view; 44. retrolateral view). Scale bars: Figs. 41-44 = 0.10mm.

Table 1. A list of wolf spiders (Lycosidae) from Taiwan, with information on their distribution, major habitat and estimated reproductive seasons.

Species	Distribution in Taiwan	Major habitat	Reproduction seasons	Reference
<i>Arctosa labiata</i> n. sp.	Central/southern Taiwan	Forests	Spring	Present study
<i>Arctosa truncate</i> n. sp.	Central Taiwan	Meadows	Summer	Present study
<i>Hippasa agelenoides</i> (Simon, 1884)	Unknown	Unknown		Chen 1996
<i>Hippasa holmerae</i> Thorell, 1895	Southern Taiwan	Meadows	Spring	Present study
<i>Lycosa coelestis</i> Koch, 1877	All over Taiwan	Meadows		Chen 2001
<i>Lycosa formosana</i> Saito, 1936	All over Taiwan	Meadows		Lee 1964
<i>Lycosa phipsoni</i> Pocock, 1899	All over Taiwan	Stony habitats		Lee 1964
<i>Lycosa boninensis</i> Tanaka, 1989	Southern Taiwan	Meadows/forest		Present study
<i>Pardosa asrtigera</i> Koch, 1878	Northern Taiwan	Meadows/arid areas		Lee 1964
<i>Pardosa laura</i> Karsch, 1879	Central Taiwan	Meadows/forests	Late summer	Present study
<i>Pardosa pseudoannulata</i> (Boes. & Str., 1906)	All over Taiwan	Meadow/Riparian		Lee 1964
<i>Pardosa takahashii</i> (Saito, 1936)	All over Taiwan	Riparian/sandy areas		Lee 1964
<i>Pardosa procurva</i> Yu & Song, 1988	Southern Taiwan	Meadows		Present study
<i>Pardosa</i> sp.	Southern Taiwan	Meadows		Present study
<i>Pirata clercki</i> (Boes. & Str., 1906)	All over Taiwan	Unknown		Yoshida 1978
<i>Pirata denticulatus</i> Lju, 1987	Central Taiwan	Meadows		Present study
<i>Pirata digitatus</i> n. sp.	Central Taiwan	Forests		Present study
<i>Trochosa ruricoloides</i> Schenkel, 1963	Southern Taiwan	Meadows		Present study
<i>Wadicosa fidelis</i> (O. P. –Cambridge, 1872)	Northern Taiwan	Meadows		Present study

Both adult male and female specimens were found all year round, with the numbers of both sexes highest in September. *P. laura* seems to prefer meadows. In study sites located in the Hui-Sun Experimental Forest Station (mid-elevation forests), *P. laura* only comprised a small portion of the wolf spider community, thus did not allow an interpretation of their phenology.

***Arctosa labiata*, new species.** – This species seems to be widely distributed in Taiwan because it was found in mid-elevation mountainous areas and southern tropical forests. *Arctosa labiata* appears to be the dominant wolf spider in mid-elevation mountainous areas. More than 40% of the catches from pitfall traps established in Hui-Sun Experimental Forest Stations were composed of *A. labiata*. Adult specimen numbers peaked in April, so it is probable that this species reproduces in spring in mid-elevations in Taiwan. In Kenting National Park, *A. labiata* comprised less than 1% of the wolf spider community, which makes an interpretation of the phenology in this region difficult.

***Lycosa boninensis* Tanaka, 1989.** – *Lycosa boninensis* seems to be the second most abundant species in tropical areas in southern Taiwan. In pitfall traps established in Kenting National Park, about 16% of the lycosids caught were this species. Females and males exhibit quite different phenological patterns. Adult females were most abundant between July and September. Adult male specimen numbers peaked three times during the year, in January, April and August and fewer males were caught than females. While most wolf spiders prefer meadow habitat, *L. boninensis* appears to have no specific habitat preference and was found from both forests and grasslands.

***Hippasa holmerae* Thorell, 1895.** – Among the three major localities examined in this study, *H. holmerae* was found only in Kenting National Park, and may have a distribution limited to southern Taiwan. *Hippasa holmerae* comprised 6% of wolf spider caught and almost all specimens were found in meadow habitats. Adult males and females were found year round in small numbers, except during the winter months. The number of males caught peaked in April suggesting that reproductive activity of this species might be higher during spring.

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