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Scientific Notes

A List of Slugs (Gastropoda: Pulmonata) Intercepted at Plant Quarantine in Japan

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Abstract: A total of 547 individual slugs were collected in our import plant quarantine inspections at Narita Airport during 2001 to 2003. 31 species are identified and listed with their exported countries and host plants.
Key words: Gastropoda, Stylommatophora, Systellommatophora, slug, intercept, plant quarantine

Introduction

Pulmonata, including slugs and land snails, was considered a subclass of Gastropoda traditionally, but recently it is treated as being in the order of Gastropoda (*e.g.*, Beesley *et al.*, 1998). Slugs are the most important crop pest in the world (*e.g.*, Barker, 2002), and they are frequently intercepted in our plants quarantine inspection; however, they have been difficult to identify, as most slugs were juveniles or eggs, and as a result, this study was conducted (2001–2003). In the result, we examined some notable slugs in intercepted materials (547 samples) at Narita Airport, Japan. This paper gives a list of 31 slug species intercepted by Narita airport plants quarantine inspection.

Materials and Methods

Intercepted immature slugs, juvenile or egg were reared in small plastic cases until they grew further. In the result, some grew and were identified completely. Here, we report a list of the available species identified based on external morphology. The nomenclature is mainly adopted from that of Abbott (1989). Limacoidea was referenced from the book by Barker (1999). The other available references for identification are described in [ ]. An asterisk (*) indicates a species that was not settled in Japan. A † means a new record by Japanese Quarantine.

Systematic List

Class GASTROPODA
  Subclass ORTHOGASTROPODA
    Superorder HETEROBRANCHIA
      Order PULMONATA
        Suborder SYSTELLOMMATOPHORA
    Family VERONICELLIDAE

1. *Laevicaulis alte* (FÉRUSSAC)
[KUBO and KUROZUMI, 1995. p. 218.]
Material examined: *Chrysalidocarpus* sp. from Taiwan; *Petroselinum crispum* (persley) from Thailand; *Dracaena* sp. from Singapore.
Remarks: *Laevicaulis* is a synonym for *Eleutherocaulis* (VAUGHT, 1989), but in the nomenclatural study of FORCAT (1969) *Eleutherocaulis* was preoccupied by *Laevicaulis*.
*2†. *Semperula*? sp.
[*cf*. BENTHEM JUTTING, 1952. pp. 332–338.]
Material examined: *Pandanus odratissimus* and *Pipper betele* (Betel pepper) from Thailand.
*3†. *Leidyula*? sp.
[*cf*. BURCH and PEARCE, 1990. pp. 235–239, Fig. 9.40.]
Material examined: *Tillandsia* sp. from Guatemala.

Suborder EUPULMONATA
Infraorder STYLOMMATOPHORA
Family PHILOMYCIDAE
4. *Meghimatium bilineatum* (BENSON)
[AZUMA, 1995. p. 100, Pl. 24, Fig. 289.]
Material examined: *Anthurium* sp. and *Asplenium* sp. from Taiwan; *Heliconia* sp. from Mauritius.
Remarks: This species seems to be a native (AZUMA, 1995) or an old introduced species in Japan. It can be considered a kind of species that returned.
*5†. *Philomycus* sp.
[*cf*. BURCH and PEARCE, 1990. pp. 260–261, Fig. 9.96.]
Material examined: *Rumora* sp. from U.S.A; *Tillandsia* sp. from Guatemala.

Family ARIONIDAE
*6. *Arion ater* (LINNAEUS)
[KERNEY and CAMERON, 1979. p. 104, Pl. 4, Fig. 2.]
Material examined: *Rheum rhabarbarum* (rhubarb) from Netherlands and France.
*7†. *Arion circumscriptus* JOHNSTON
[KERNEY and CAMERON, 1979. p. 105, Pl. 5, Fig. 3.]
Material examined: *Ornithogalum* sp. from France.
*8†. *Arion fasciatus* (NILSSON)
[KERNEY and CAMERON, 1979. p. 105, Pl. 5, Fig. 2.]
Material examined: *Rheum rhabarbarum* (rhubarb) from U.S.A.
*9. *Arion hortensis* FÉRUSSAC
[BARKER, 1999. pp. 45–47, Figs. 32, C5.]
Material examined: *Erica* sp. from U.K.; *Danae* sp. from Italy.
*10†. *Arion intermedius* NORMAND
[BARKER, 1999. pp. 48–50, Figs. 33, C6.]
Material examined: *Rheum rhabarbarum* (rhubarb) from Netherlands; *Leucospermum* sp. from South Africa.

*11†. *Arion lusitanicus* MABILLE
[KERNEY and CAMERON, 1979. p. 104, Pl. 4, Fig. 3.]
Material examined: *Cichorium* sp. from Italy; *Rheum rhabarbarum* (Rhubarb) from U.S.A.
*12†. *Arion rufus* (LINNAEUS)
[KERNEY and CAMERON, 1979. p. 104, Pl. 4, Fig. 2e.; PFLEGER and CHATFIELD, 1988. pp. 82–83.]
Material examined: *Ornithogalum* sp. from France; *Rheum rhabarbarum* (rhubarb) from Netherlands.
*13†. *Arion* sp.
[*cf*. KERNEY and CAMERON, 1979. pp. 104–105, Pl. 5.]
Material examined: *Danae* sp. from Italy.
*14†. *Hemphillia*? sp.
[*cf*. BURCH, and PEARCE, 1990. p. 265, Fig. 9.14.]
Material examined: *Gaultheria* sp. from U.S.A.
Remarks: Only one juvenile was collected.

Family ATHORACOPHORIDAE
*15†. *Athracophorus bitentaculatus* (QUOY & GAIMARD) ?
[*cf*. BARKER, 2002. p. 422.]
Material examined: *Protea* sp. and *Zantedeschia* sp. from New Zealand.

Family LIMACIDAE
16. *Lehmannia valentiana* (FÉRUSSAC)
[BARKER, 1999. pp. 79–81, Figs. 42, C16.]
Material examined: *Lilium* sp. from Southern Korea; *Skimmia* sp. from Belgium; *Ilex integra* from Denmark; *Tillandsia* sp. from Italy; *Skimmia* sp. from Netherlands; *Fragaria* x *ananassa* (strawberry) from U.S.A.; *Tillandsia* sp. from Guatemala; *Protea* sp. and *Brunia* sp. from Australia.
Remarks: We cannot distinguish this species and *L. nyctelia* (BOURGUIGNAT, 1861) in external morphology. Thus, two species may be included in these records.
17. *Limacus flavus* (LINNAEUS)
[BARKER, 1999. pp. 81–83, Figs. 43, C17, 18.]
Material examined: *Smilax* sp. from Italy.
*18. *Limax maximus* (LINNAEUS)
[BARKER, 1999. pp. 84–86, Figs. 44, C19.]
Material examined: *Rheum rhabarbarum* (rhubarb) from Netherlands; *Gaultheria* sp. from U.S.A.
Remarks: This species was recorded from Japan (the Japanese Society of Applied Entomology and Zoology, 1987), but Japanese malacologists do not recognize introduction of this species into Japan (KURODA, 1963; AZUMA, 1995).

Family AGRIOLIMACIAE
19. *Deroceras* (s.s.) *laeve* (MÜLLER)
[BARKER, 1999. pp. 32–35, Figs. 25, C1.]

Material examined: *Fragaria* x *ananassa* (strawberry) from Southern Korea; *Impatiens* sp. from Sri Lanka; *Pittosporum* sp. from Israel.

*20†. *Deroceras* (s.s.) *panormitanum* (LESSONA & POLLONERA)

[BARKER, 1999. pp. 35–37, Figs. 26, C2.]

Material examined: *Alstroemeria* sp. from Netherlands.

*21. *Deroceras* (*Agliolimax*) *reticulatum* (MÜLLER)

[BARKER, 1999. pp. 38–41, Figs. 27, C3.]

Material examined: *Danae* sp., *Brassica oleracea* var. *botrytis* (cauliflower), *Brassica rapa* (turnip), *Cichorium imtybus* (red salad), *Cynara cardunculus*, *Cynara* sp., *Eruca sativa* (rocket salad), *Foeniculum vulgare* (fennel), *Ilex* sp., *Pittosporum* sp., *Rheum rhabarbarum* (rhubarb) and *Viburnum* sp. from Italy; *Alstroemeria* sp., *Brassica oleracea* var. *bullata* (Savoy cabbage), *Cucurbita pepo* (zucchini), *Dianthus* sp., *Eleocharis* sp., *Foeniculum vulgare* (fennel), *Pernettya* sp., *Rheum rhabarbarum* (rhubarb) and *Skimmia* sp. from Netherlands; *Cynara scolymus* (artichoke) and *Cynara cardunculus* (cardoon) from Spain; *Hibiscus* sp. and *Ilex* sp. from Denmark; *Gaultheria* sp. from Germany; *Cynara scolymus* (artichoke) and *Brassica oleracea* var. *bullata* (Savoy cabbage) from France; *Annona cherimola* (cherimoya), *Petroselinum crispum* (persley), *Rubus idaeus* (red raspberry), *Rheum rhabarbarum* (rhubarb) and *Fragaria* x *ananassa* (strawberry) from U.S.A.; *Rumohra* sp. from Costa Rica; *Hypericum* sp. from Ecuador; *Apium graveoleus* var. *rapaceum* (celeriac); *Rheum rhabarbarum* (rhubarb) and *Allium ampeloprasum* (leek) from Australia; and *Asparagus officinalis* (asparagus) from New Zealand.

Remarks: This species was recorded from Japan (the Japanese Society of Applied Entomology and Zoology (ed.), 1987; KURODA,1963; AZUMA, 1995), but detailed anatomical study has not been conducted. KANO and GOTO (1996) showed that the so-called "*D. reticulatum*" in Yokohama of Japan was *D. leave*. And KUROZUMI (pres. obser.) did not find *D. reticulatum* any place in Japan. More detailed studies are needed to confirm settlement of this species in Japan.

*22. *Deroceras* (*Agliolimax*) sp. cf. *agreste* (LINNAEUS)

[*cf*. KERNEY and CAMERON, 1979. p. 143, Pl. 14. Fig. 3.]

Material examined: *Cucurbita pepo* (zucchini) from Netherlands; *Cynara scolymus* (artichoke) from Spain.

Remarks: *D. agreste* was recorded from Japan (the Japanese Society of Applied Entomology and Zoology, 1987), but Japanese malacologists do not recognize this species as having invaded into Japan (KURODA, 1963; AZUMA, 1995).

*23†. *Deroceras* (*Agliolimax*)? sp.

[*cf*. KERNEY and CAMERON, 1979. pp. 142–146, Pl. 14. Fig. 3.]

Material examined: *Hydrocotyle* sp. from Demark; *Brassica juncea* (mustard), *Dianthus* sp., *Brassica oleracea* (kale) and *Fragaria* x *ananassa* (strawberry) from U.S.A.; *Rheum rhabarbarum* (rhubarb) from Australia.

Family MILACIDAE

24. *Milax gigantes* (DRAPARNAUD)

[BARKER, 1999. pp. 87–90, Figs. 49, C20, 21.]

Material examined: *Danae* sp. from Italy; *Apium graveoleus* var. *rapaceum* (celeriac) from Australia.

*25†. *Milax* sp.

[*cf*. KERNEY and CAMERON, 1979. pp. 127–131, Pl. 12.]

Material examined: *Brassica oleracea* var. *bullata* (savoy cabbage) from Australia.

*26†. *Tandonia budapestensis* (HAZAY)

[BARKER, 1999. pp. 90–92, Figs. 50, C22.]

Material examined: *Pittosporum* sp. from Italy.

Family ARIOPHANTIDAE

27. *Parmarion martensi* SIMROTH

[MINATO, 1975. pp. 109–111, Text-fig. 1.]

Material examined: *Hydrangea* sp. from Indonesia; *Cordyline* sp. and *Dracaena* sp. from Malaysia; *Dracaena* sp. from Singapore; *Livistona* sp. from Sri Lanka.

*28†. *Parmarion* sp.

[*cf*. MINATO, 1975. pp. 109–111.]

Material examined: *Gaultheria* sp. from Indonesia; *Corotopelalum* sp. from Australia.

*29†. *Mariaella dussumieri* GRAY

[BLANFORD and GODWIN-AUSTEN, 1908. pp. 205–206, Fig. 71.]

Material examined: *Gaultheria* sp. and *Liristna* sp. from Sri Lanka.

*30†. *Mariaella*? sp.

[*cf*. BLANFORD and GODWIN-AUSTEN, 1908. pp. 205–206.]

Material examined: *Livistona* sp. from Sri Lanka.

Remarks: Only one juvenile was collected.

*31†. *Cerataconta*? sp.

[*cf*. ZILCH, 1959–1960. p. 320, Fig. 1166.]

Material examined: *Dracaena* sp. from Malaysia.

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和 文 摘 要

輸入植物から発見されたナメクジ類（腹足綱，有肺目）

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ナメクジ類は、農業害虫としても重要で、我が国に輸入されてくる植物に付着して検疫時にしばしば発見されている。しかし、これらは卵や幼体で発見されることが多く、詳細な調査がされていない。このため成田空港において、平成 13 年から平成 15 年までの期間、輸入検疫時に発見されるナメクジ類（547 個体）を保管・飼育して調査した。その結果、少なくとも 31 種につき種名又は属名まで明らかになったので、その付着してきた植物とその仕出し国とともに種名をリストした。

Fig. 1. Slugs species intercepted at plant quarantine in Japan.

① *Laevicaulis alte* ② *Meghimatium bilineatum* ③ *Arion intermedius*
④ *A. rufus* ⑤ *Lehmannia valentiana* ⑥ *Limacus flavus*
⑦ *Deroceras laeve* ⑧ *D. reticulatum* ⑨ *Milax gigantes*
⑩ *Tandonia budapestensis* ⑪ *Parmarion martensi* ⑫ *Athracophorus bitentaculatus*?

Scales: 10 mm.