

19. TOXIC ACTION OF ROVE BEETLES (COLEOPTERA, STAPHYLINIDAE)

A. FAIN

Institut de Médecine Tropicale, Antwerpen, Belgique

INTRODUCTION

The vesicant action of beetles belonging to the genus *Paederus* (STAPHYLINIDAE) was recognized for the first time by da Silva, in 1912 (1), in Brazil.

The species involved was *Paederus columbinus* Lap.. This insect is frequently encountered in the region of Bahia from June to September, especially along the borders of the main streams. It appears to be a positive pest for people working in the fields of potatoes, corn or beans and it is well known to them under the name of "potó" or "trepa moleque". When these insects alight on the bare skin they produce a pruriginous erythema which is followed by a blister and a slowly healing ulceration. These lesions occur on the legs, the arms and the neck.

Since the paper of da Silva (1) many other authors have reported similar observations in different parts of the world and involving various species of *Paederus*. A general review of that question appeared in the thesis of Allard (2), in 1948. This work was completed by Theodorides in 1950 (3) and more recently by the thesis of Gruvel (4). Several other contributions have been added during the last years. Among them the most important seem to be those of Pavan and Bo (5, 6) and Pavan (7, 8) on the nature of the toxic factor responsible for the cutaneous or ocular lesions.

The rove beetles are characterized by their narrow body and their short elytra under which the long membranous posterior wings are folded. They have beautiful colours. In *P. sabaesus* the head and the posterior segments of the abdomen are black, the thorax and the anterior part of the abdomen brownish-yellow, the elytra metallic blue. Most of the species are small, measuring not more than 1 cm in length. Some species have the habit of curling the abdomen over the thorax, and they may therefore easily be mistaken for flying ants.

GEOGRAPHICAL DISTRIBUTION OF THE ROVE BEETLE DERMATITIS

The dermatitis produced by the beetles of the family STAPHYLINIDAE has been observed on the five continents. So far the vesicant properties have been recognized as belonging only to the genus *Paederus*. It is to be noted, however, that the species *ruficollis* which is known as producing experimental dermatitis, has been removed recently from the genus *Paederus* and placed

in the genus *Paederidus* Rey (Fig. 6). According to Mr. G. Fagel of Brussels, the well-known specialist in the study of these beetles, some of the South-American species could, in fact, belong to other genera of the STAPHYLINIDAE. The genus *Paederus* has a world wide distribution and is represented by several hundred species among which a small number, not more than 30, have been recorded in relation with human dermatitis. It seems, however, very probable that the majority of the species of *Paederus* contain a vesicant fluid. Specific identification in that group is very difficult and may be made only by an expert.

In South America the rove beetle dermatitis has been reported for the first time in Bahia, Brazil, by da Silva in 1912 (1) in connection with *Paederus columbinus* Laporte.

Soon thereafter, Göldi in 1913 (9) observed the same toxic action in the species *Paederus goeldi* (Wasmann, 1905) in Amazonas, Brazil. A third species, *Paederus amazonicus* (Sharp) has been mentioned by Bequaert (10) as causing dermatitis, in the same country. Another recorded from Brazil is that of Gordon (11) who stated that *Paederus amazonicus* had been first encountered at Manaus, Amazonas, in January 1921. Froes (12, 13) in Bahia, Brazil, showed experimentally that *Paederus brasiliensis* Er. (Fig. 5) and *Paederus rutilicornis* Er. are able to produce vesicular dermatitis. More recently Pickel (14) has mentioned the presence in Brazil of 20 species of *Paederus*, among which only 6 are strongly vesicant. He also noted that *Paederus ferus* Er. and *P. brasiliensis* Er. produce dermatitis in Pernambuco.

In Ecuador epidemic vesicular dermatitis in man was observed by Chapin (15) in 1926 in connection with *Paederus irritans* Chap.. Soon after, Campos (16) reported cases produced by 8 different species of *Paederus*. Earle (17), in 1949 described cases of dermatitis in connection with *Paederus ornaticornis* Sharp. In this country the disease is known under the name "Fuetazo dermatitis". The name "fuetazo" is a Spanish word for whiplash. It calls attention to the linear aspect of the lesions, especially when they occur on the face.

According to Dallas (18, 19) vesicular dermatitis is produced in Argentina by *Paederus brasiliensis* Er. and *P. ferus* Er..

Bequaert (20) has shown that *Paederus signaticornis* Sharp causes dermatitis in Guatemala.

In Africa the first report of rove beetles dermatitis is that of Rodhain and Houssiau in 1915 (21) in Leopoldville, Congo. The species involved in these cases was identified by H. Notman (in Bequaert, 10) as *Paederus sabaeus* Er. (Fig. 3). In 1916, Ross (22) showed that *Paederus eximius* Reiche (synonym = *P. crebrepunctatus* Eppelsheim) is the agent of a vesicular dermatitis in Kenya (Fig. 2). In several parts of Kenya, especially in Nairobi, this species may also produce a severe conjunctivitis which is known as "Nairobi-Eye" (see Symes and Roberts — 23 — and Roberts and Tonking — 24 —). Other records of dermatitis produced in Africa by *Paederus sabaeus* are those of Gordon (11) in West Africa, of Lewis (25) in Sudan and of Denys and Zumpt (26) in South West Africa and in Nyasaland.

In Europe, Sacharow, in 1915 (27) reported cases of dermatitis produced by *Paederus fuscipes* Curt (= *P. idae* Sharp) in Southern Russia (Fig. 1). Several other authors have confirmed these observations (Portchinsky, 1915 — 28 —, and Pawlowsky and Stein, 1926 — 29 —). This species is very common along the banks of the lower Volga and fishermen and herdsmen are commonly

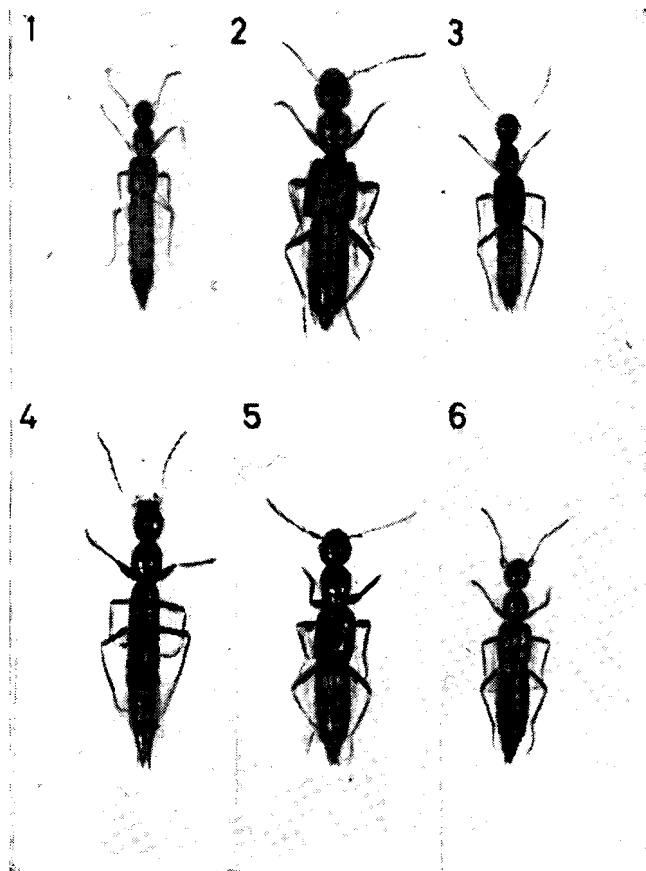


Fig. 1-6 — Some harmful Rove-beetles:

- Fig. 1 — *Paederus fuscipes* Curtis
- Fig. 2 — *Paederus eximius* Reiche.
- Fig. 3 — *Paederus sabaeus* Er.
- Fig. 4 — *Paederus ornaticornis* Sharp
- Fig. 5 — *Paederus brasiliensis* Er.
- Fig. 6 — *Paederidus ruficollis* Fabr.

(Photograph made by Institut des Sciences Naturelles
de Belgique, Brussels).

blistered by the crushing of beetles on the skin. In 1919, Netolitzky (30), in Bukovine, was able to produce experimental dermatitis in man with two other European species (*Paederus limnophilus* Er. and *Paederus ruficollis* Fab. — Fig. 6). Experimental dermatitis in man has also been produced in France by Allard (2) with *Paederus littoralis* Grav. and by Theodorides (3) with *P. riparius* L. and *P. fuscipes* Curt.. It is in Italy that the irritant action of *Paederus* on the eye has been recognized for the first time by Farina in 1926 (31). These lesions seem to be rather common in that country and Castelli in 1935 (32) recorded numerous cases of conjunctivitis that he called "Oftalmozoosi endemica di *Paederus*". All these ocular lesions were produced by *Paederus fuscipes*.

In Asia the vesicular dermatitis has been reported from several countries. In India the disease is known as "Spiderlick" and is produced mainly by *Paederus fuscipes* Curt. (cited by Strickland — 33 — Strickland and Roy — 34 — and Isaac — 35 —). Pujatti, in 1947 (36) reports that *Paederus melampus* Er. produces dermatitis in the State of Benagalore (India).

According to Eysell (37), *Paederus peregrinus* Er. is able to produce similar lesions in Malaysia.

In Indochina epidemic dermatitis is produced by *Paederus fuscipes* and *P. alternans* Walk (see Genevray and col., 38).

Rove beetles dermatitis has also been observed in Japan by Wada in 1926(39). The species involved was *Paederus riparius* L.. Esaki (40) reports that the dermatitis produced by *P. idae*, which is a synonym of *P. fuscipes* Curt. has been known in Japan, Korea and China since 1590, and Kandu Kanji, in 1935 (41), mentions that severe ocular lesions are produced by this species in Formosa.

More recently the vesicular dermatitis has been reported from Australia, by Millard in 1954 (42). The disease is produced by *Paederus cruenticollis* Germ.

BIOLOGY OF THE *PAEDERUS* SPP.

Many of the authors observing rove beetle dermatitis in man have drawn attention to the seasonal character of the disease. In Brazil *Paederus columbinus* is encountered from June to September. In Ecuador the beetles appear with the first rains in December or January and persist until the onset of the dry season in May or June. In Leopoldville, Central Africa, *Paederus sabaeus* is frequent from April to June, and completely absent at any other time of the year (Rodhain and Houssiau and personal observations). This period corresponds with the end of the raining season and the beginning of the dry season. According to Dr. C. Rossetti (University Lovanium), the beetle population in Leopoldville reaches a peak every two years (personal comm.). In South West Africa, Deneys and Zumpt (26) report cases of dermatitis produced by *P. sabaeus* during the month of December. In Freetown, Sierra Leone, *P. sabaeus* is fairly common during June, July and August; it disappears during September and October but reappears in the middle of November (Gordon, 11).

In India, Isaac (35) has noted that *Paederus fuscipes* reaches its greatest density in May and June, when the vesicular dermatitis become abundant. In the same country Pujatti (36) made similar observations with *Paederus melampus* which occurred mainly from May to July.

These observations show that in tropical regions the beetles are most frequent or at least most active during the rainy and hot season. That a high degree of humidity is an important condition for the activity of these beetles is shown by the fact that *Paederus fuscipes*, *P. sabaeus*, *P. eximius* and other species are always found close to river banks or swampy areas. In Europe the most favourable conditions are realized at the end of the Summer.

This periodicity seems, however, not to be absolute, for in Manaus, Amazonas (Brazil), Gordon (11) reports that *Paederus amazonicus* is common in all the seasons of the year.

Another feature that is to be mentioned in relation with the biology of those beetles is the fact that some species are attracted to the artificial light. It seems therefore very probable that some cases of dermatitis are contracted during the night.

PATHOGENY OF THE ROVE BEETLES

Dermatitis is the most commonly pathological feature observed in relation with rove beetles; however, in some cases eye lesions may also have been produced. The latter are generally a result of the spread of the irritant with the fingers and they are therefore secondary to the crushing of the insect on the skin.

The skin lesions consist essentially of a vesicular dermatitis and they are usually seen on the exposed parts of the body. The clinical evolution of this dermatitis is rather characteristic. A good description has been made by Theodorides (3) who experimented upon himself with *Paederus fuscipes*. This author divided the lesions into three stages: an *erythematous stage* characterized by a red patch, a *vesicular stage* following the preceding one during which the blisters appeared, and a *squamous* or *healing stage*. The erythematous stage developed approximately 10 hours after contact with the beetle and it persisted during 48 hours. The macula was not spontaneously painful but presented a tickling or burning sensation. The first blisters appeared 48 hours after the beginning of the erythema. They enlarged gradually and attained their complete development within 2 days. During the healing stage the vesicles became umbilicate and dried out. Finally they exfoliated leaving pigmented scars which persisted for two months. The healing stage began 6 days after the contact with the beetle; it persisted for about 8 days.

The spontaneous dermatitis that I have observed in Leopoldville with *Paederus sabaenus* presents a similar evolution (Fig. 7). In some cases the maculas coalesce into large areas up to 10 cm in diameter. A linear dermatitis, 5-15 cm long, may appear at the place where the beetle has been dragged along the skin when brushed off by the hand. The lesions are not spontaneously painful;

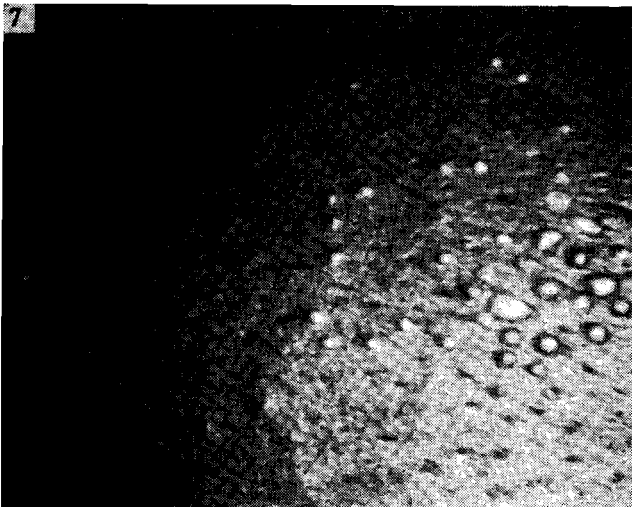


Fig. 7 — Rove-beetle dermatitis on the arm of an African in Leopoldville. (Photograph made by Prof. C. Rossetti).

however, a slight burning sensation followed by itching may be present. The vesicles, which are generally very small, contain either a clear or a seropurulent fluid. In some cases they coalesce to form a single large blister. The lesions produced in East Africa by *Paederus eximius* (= *P. crebrepunctatus*) are more severe and are often accompanied by general symptoms.

When the irritant enters into the eye, conjunctivitis may occur. Ocular lesions have been described for the first time in Italy. They were produced by *P. fuscipes*. These lesions are more frequently encountered and more severe with *Paederus eximius* than with other species of *Paederus*. They are well known in Kenya as "Nairobi-Eye".

According to Göldi (9) the hemorrhagic enteritis, well known in the Marshall Islands as "Toddy Disease" is probably produced by swallowing of palm-wine (called also "toddy") into which some rove beetles have fallen. So far the toxic action of rove beetles for the digestive tract in man or in animals is not established with certainty. In that respect it seems that these beetles are less pathogenic than those of the family MELOIDAE whose irritating power for the digestive mucosa is well known in man and in animals.

NATURE OF THE IRRITANT PRINCIPLE OF THE ROVE BEETLES

Da Silva (1) thought that the irritant substance responsible for the dermatitis was a secretion of the beetle.

Rodhain and Houssiau (21) experimenting on man with *Paederus sabaeus* in Leopoldville showed that when the insects were allowed to wander freely over the skin and even when they were irritated, no lesions, either immediate or delayed, were produced. The lesions appeared only when the beetles were crushed and rubbed over the skin. Other authors have repeated these experiments with the same results.

Gordon (11) found that the reaction occurs on areas smeared with the thorax and the abdomen of the beetle but none with the head.

Pawlowsky and Stein (43), experimenting with *P. fuscipes*, have shown that the irritant principle is always present in the genital organs and that it reaches its highest concentration in the haemolymph.

Some observations have proved that the irritant can be absorbed through a non-injured epidermis. It seems probable that the softening of the skin by an excessive perspiration or after bathing makes this penetration more easy and that on the contrary a greasy condition of the skin lessens its action.

So far it had been commonly thought that this irritant was cantharidin. Netolitsky (30) was the first to surmise that the active principle contained in the rove beetles is not cantharidin. Pawlowsky and Stein, in 1920 expressed the same opinion. The true nature of this principle has been shown by Pavan and Bo (5, 6) and by Pavan (7, 8). These authors succeeded in isolating and obtaining in its pure crystalline state the active principle of the vesicant substance, to which they give the name of "pederin". They also proved that pederin is clearly distinct from cantharidin not only in terms of its biological but also in terms of its physical and chemical properties.

DIAGNOSIS OF THE ROVE BEETLE DERMATITIS

The diagnosis of the disease is generally not difficult. It should be based on the following characteristics:

1. The sudden appearance of the lesions.
2. The absence of bilateral symmetry of the lesions. Generally only one region of the body is affected.
3. The aspect of the lesions consisting often of a group of small vesicles or of a single larger vesicle. The linear grouping of the vesicles is characteristic.
4. The seasonal and epidemic character of the disease.

The long delay (2 to 3 days) between the contact with the beetle and the appearance of the vesicles may render the diagnosis difficult in absence of an epidemy.

It may be difficult to distinguish the rove beetle dermatitis from the cantharid dermatitis which is produced by beetles of the family MELOIDAE, especially the genera *Lytta*, *Epicauta* and *Mylabris*. The best known of them is the bright metallic green "Spanish fly", *Lytta vesicatoria*.

According to Theodorides(44) the vesicle produced by cantharidin develops on the normal skin while that produced by the *Paederus sp.* is always preceded by an erythema.

Bo and Vancurone (45) have summarized in a table their experiences on man with either cantharidin and pederin (see Table I).

TABLE I — DIFFERENCES BETWEEN THE EXPERIMENTAL DERMATITIS PRODUCED IN MAN BY CANTHARIDIN AND THAT PRODUCED BY PEDERIN. (AFTER BO AND VALCURONE, 1958).

	Lesion produced by catharidin (beetles of the family MELOIDAE)	Lesion produced by pederin (beetles of the family STAPHYLINIDAE)
Delay between the contact of the irritant and the onset of the erythema	18 — 24 hours.	36 — 72 hours.
Character of the erythema	Mild, without any subjective symptoms.	Well developed and painful.
Character of the vesicle	Small bullae coalescing quickly into a single voluminous blister. This blister contains a clear fluid and is situated on a superficial base. Subjective symptoms almost absent.	Small, or very small, vesicles containing clear fluid transforming into larger pustules (with purulent fluid) which tend to coalesce. These pustules are situated on a deep base. Subjective symptoms, very marked, consisting of pruritis and burning sensation.
Healing	Either by resorption or bursting of the blister.	By formation of a squamous crust.
Residual lesion ...	Pigmentation, if present, is light and disappears rapidly.	Pigmentation well developed and persisting. Pruritis may be present.

TREATMENT OF THE ROVE BEETLE DERMATITIS

Roberts and Tonking (46) have treated the blisters with Magnesium Sulfate compresses.

Earle (17) recommends a formula containing, among other drugs, Butesin picrate.

Deneys and Zumpt (26) found that cortisone and antihistaminic preparations had no beneficial effect and may even be harmful by favouring secondary infection. They recommend to treat the more severe lesions by protection and the application of an antibiotic powder.

In Leopoldville, on the advice of Professor C. Rossetti (University Lovanium), we have treated our cases with the water paster of Darier (equal parts of Talc, Zinc Oxyde, Glycerine, Water) with good results.

Acknowledgments — I am indebted to Prof. C. Rossetti, University Lovanium, Leopoldville, Republique of Congo, who furnished unpublished information and photograph on rove-beetle dermatitis at Leopoldville.

I also wish to thank Mr. G. Fagel, Institut des Parcs Nationaux du Congo, Brussels, who reviewed the taxonomic part of the manuscript and supplied the material for illustration of some *Paederus* sp.

REFERENCES

1. SILVA, P. da, *Arch. Parasitol.*, **15**, 429-430, pl. I, 1912.
2. ALLARD, V., Les Staphylinides vésicants du genre *Paederus*. Thèse. Imprim. R. Foulon, Paris, 1948, pp. 1-54.
3. THEODORIDES, J., *Bull. Soc. Path. exot.*, **43**, 100-113, 2 pl., 1950 b.
4. GRUVEL, J., Les Coléoptères vésicants. Thèse. Impr. R. Foulon, Paris, 1957, pp. 1-63.
5. PAVAN, M., and BO, G., *Mem. Soc. entomol. ital.*, **31**, 67-82, 1952.
6. PAVAN, M., and BO, G., *Fisiol. Comp. Oecol.*, **3** (2-3), 307-312, 1953.
7. PAVAN, M., *Atti Acc. Naz. It. Entomol.*, Rendiconti, **10**, 119-124, 1962.
8. PAVAN, M., *Ricerche biologiche mediche su pederina e su estratti purificati di Paederus fuscipes* Curt., Impr. Mario Ponzio, Pavia, 1963, pp. 1-93.
9. GÖLDI, E. A., *Die sanitär-pathologische Bedeutung der Insekten*, 1913.
10. BEQUAERT, J., *Ann. Soc. belge Méd. trop.*, **1** (2), 227-229, 1921.
11. GORDON, M. R., *Ann. trop. Med. Parasit.*, **19** (1), 47-52, pl. I, 1925.
12. FROES, H. P., *Rev. med. Bahia*, **9**, 290-292, 1934.
13. FROES, H. P., *J. Parasitol.*, **21** (2), 124, 1935.
14. PICKEL, D. B., *Rev. Entomol.*, Rio de Janeiro, **11**, 775-793, 1940.

15. CHAPIN, E. A., *Arch. Schiffs-u. Tropenhyg.*, **30**, 369-372, 1926.
16. CAMPOS, R. F., *Rev. Col. Rocafuerte*, Guayaquil., N.os 27-28, 1927.
17. EARLE, K. V., *J. trop. Med. Hyg.*, **52**, 183-187, 1949.
18. DALLAS, E. D., *Soc. argent. Patol. Reg. Norte*, Buenos Aires, 1163-1167, 1930.
19. DALLAS, E. D., *Rev. chil. Hist. Nat.*, **39**, 219-224, 1935.
20. BEQUAERT, J., *Bull. Brookl. entomol. Soc.*, **27**, 107-112, 1932.
21. RODHAIN, J., et HOUSSIAU, J., *Bull. Soc. Path. exot.*, **8**, 587-591, 1915.
22. ROSS, P. H., *J. trop. Med. Hyg.*, **19**, 202, 1916.
23. SYMES, C. B., and ROBERTS, J. I., *Rep. med. Res. Kenya*, Nairobi, (1932), 21-27, 1934.
24. ROBERTS, J. I., and TONKING, H. D., *Ann. trop. Med.*, **29**, 415-420, 1935.
25. LEWIS, D. J., *Proc. royal entomol. Soc. London*, **33**, 37-42, 1958.
26. DENEYS, J. B., and ZUMPT, F., *S. A. med. J.*, **37**, 1284-1285, 1963.
27. SACHAROW, N., The injurious insects noticed in the Govt. of Astrachan, from 1912 to 1914. From the report of the Station for 1914. Publ. of the Entom. Station of Astrachan, 1915.
28. PORTCHINSKY, I. A., *Friend of Nature*, Petrograd (in Russian), **12**, 364-366, 1915.
29. PAWLOWSKI, E. N., und STEIN, A. K., *Med. Obozr. Nizn. Povolz.*, N.os 7-8 Astrakhan (in Russian), 1926 a. *Trans. royal Soc. Trop. Med. Hyg.*, **20**, 450-451, 1926 b.
30. NETOLITZKY, F., *Z. angew. Entomol.*, **5**, 252-257, 1919.
31. FARINA, F., *Lett. Oftalm.*, **10**, 1926.
32. CASTELLI, A., *Ann. Ottal.*, **63** (3-4), 204-228, tav. I-VI, 1935.
33. STRICKLAND, C., *Indian med. Gaz.*, **8**, 1924.
34. STRICKLAND, C., and ROY, D. N., *Indian med. Gaz.*, **74**, 285, 1939.
35. ISAAC, P. V., *Agr. Live-Stock India*, **3**, 33-36, 1934.
36. PUJATTI, D., *Mem. Soc. entomol. ital.*, **26**, 5-11, 1947.
37. EYSELL, A., *Handbuch der Tropenkrankheiten*, Vol. 1, 1913, p. 247.
38. GENEVRAY, J., GASCHEN, H., AUTRET, M. et DODERO, J., *Arch. Inst. Pasteur Indochine*, **19**, 313-329, 1934.
39. WADA, H., *Jap. J. Dermatol.*, **26** (11), 68-70, 1044-1060, 1 pl., 1926.
40. ESAKI, T., *Honzo*, Tokio, **11**, 27-31, 1933.
41. KANDU KANJI, *Taiwan Igak. Zass*, **34**, 1013-1014, 1935.
42. MILLARD, P. T., *Med. J. Aust.*, **1** (20), 741-744, 1954.

43. PAWLOWSKY, E. N., and STEIN, A. K., *Arch. Schiffs-u. Tropenhyg.*, **31**, 271-282, 1927.
44. THEODORIDES, J., Remarques sur les *Paederus vésicants*. *Trans. 9th. Int. Congr. Ent.*, **1**, 969-970, 1952.
45. BO, G., and VALCURONE, M. L., *Bull. Soc. med. Chirurgie, Pavia*, **72** (5-6), 1-12, 1958.
45. BO, G., and VALCURONE, M. L., *Bull. Soc. med. Chirurgie, Pavia*, **72** (5-6),